Suthida Chamrat 2009: Exploring Thai Grade 10 Chemistry Students' Understanding of Atomic Structure Concepts and the Nature of Science through the Model-based Approach. Doctor of Philosophy (Science Education), Major Field: Science Education, Department of Education. Thesis Advisor: Assistant Professor Naruemon Yutakom, Ph.D. 412 pages.

This study aimed to explore the influences of teachers' implementing the Atomic Structure Instructional Unit (ASIU), on students' conceptions of the nature of science and atomic structure. Nature of science has become an important goal for science education internationally. Science educators agree that the nature of science promotes students understanding of scientific content. Furthermore, the nature of science is an essential feature of science literacy. It is also recognized that science curriculum is best taught in the context of inquiry-based learning that incorporates the nature of science. Such teaching-learning may result in the development of an intellectual approach to science that can have long-lasting effects on both science and society. Improved teaching-learning of atomic structure is one of those areas that is important for understanding the wider implications of connecting science and society. The study is premised on the notion that student's conceptions of the nature of science and atomic structure needed to be improved.

The ASIU was developed based on identifying key curriculum documents and using findings from phase I in this research: (1) current teaching and learning of atomic structure, (2) students' understanding of the nature of science and atomic structure, and (3) teachers' understanding of the nature of science. A model-based approach was used as the framework for instructional unit design in which learners participated in model and modeling activities such as constructing, comparing, contrasting, critiquing, and modifying models. Effects of the ASIU on students' understanding were explored through classroom observations, interviews, the Atomic Structure Concept Test (ASCT), the Nature of Science Questionnaire (NOSQ) and documentary data. The model and modeling activities encouraged students to shift from memorizing content without understanding to rational thinking for supporting their explanations. For example, students connected scientists' experiments to the atomic model being constructed. The reflection and discussion of the students' experiences in the lessons resulted in students' conceptualization of core aspects of the nature of science. For example, science relies on evidence, role of creativity and imagination in science, and observation and inference. Furthermore, it was found that students changed from passive learners to active participants by engaging in model thinking and modeling activities.

The overall findings of this study suggests that the designed instructional units, based on exploration of the current frameworks in teaching and learning atomic structure and the nature of science, coupled with a model-based approach, can be used to develop an informed understanding of the nature of science, and concurrently lead to an enriched understanding for concepts of atomic structure. However, there are key points that emerged in this study that need to be addressed: The teachers' teaching of atomic structure, with the integration of the nature of science, was influenced by their background and characteristics, their commitment to change, their understandings of the nature of science, and their dependence and familiarity of using lecture as a "reliable" method of instruction. Thus, these factors seem to be the most important determinants in developing student understanding for the nature of science. The outcome is that successful implementation of a model-based curriculum is critically dependent upon carefully planned professional development experiences for teachers.

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