

Jurarat Liangkriilas 2009: Development of Level 4 Biology Students' Understanding of the Nature of Science in the Context of the Unit on Respiration: Explicit and Reflective Inquiry – based Approach. Doctor of Philosophy (Science Education), Major Field: Science Education, Department of Education. Thesis Advisor: Assistant Professor Naruemon Yutakom, Ph.D. 285 pages.

The purposes of this interpretive case study were a) to investigate the impact of an instructional unit that integrated aspects of the nature of science (NOS) using explicit and reflective inquiry – based approach on students' understanding the nature of science as well as their knowledge of respiration concepts; and b) to investigate what ways teachers' teaching practices influenced students' understandings of the NOS and respiration concepts. The participants of this study consisted of three biology teachers at level 4 and their students, eight students per teacher, totally 24 students. The participants were purposefully selected from secondary schools at Pranakornsriyutthaya province. Interviews, classroom observation field notes, a respiration concept survey and focus groups were used as sources of data collection. The respiration instructional unit (RIU) was developed by integrating aspects of the NOS using explicit and reflective inquiry – based approach and was implemented to investigate students' understanding of the nature of science and key concepts of respiration and teaching practices. The study emphasized six aspects of the NOS including scientific knowledge based on empirical evidence, scientific knowledge as socially constructed, science as social activity, the role of creativity and imagination, the tentative nature of science, and diversity of scientific method. The respiration knowledge included four topics namely the definition of respiration, aerobic respiration, anaerobic respiration, and the relation between cellular respiration and gas exchange.

After implementing the RIU, the findings indicated that all students in this study improved their understanding of the NOS aspects and the knowledge of respiration. Most students held informed understanding of scientific knowledge as being based on evidence, scientific knowledge as socially constructed, and the diversity of approaches to research design that are labeled as the scientific method. All students exhibited partial understanding of respiration. The findings from three cases showed that teaching practices were an essential component of support for students' understanding both of the NOS and the knowledge of respiration. Among the three teachers, there was little consistency in the ways they assisted students in learning and constructing knowledge through the lesson. The different roles of teachers during discussion influenced the development of students' understanding. The results of this research support the finding that developing students' informed understanding of the NOS is a cognitive instructional outcome that requires an explicit and reflective instructional approach. This research demonstrates that the NOS aspects of the lesson are best accomplished when the teacher makes them explicit and reflective from the subject matter content knowledge. Integrating history of science into science teaching improves students' understanding the NOS if teachers are explicit in their teaching.

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Thesis Advisor's Signature

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