

“Scientific reasoning on lower secondary school students —Focusing on model based reasoning—

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Reasoning skills are major contributors to academic and everyday life success (Zeineddin & Abd-El-Khalick, 2010). As a consequence, the development of students' scientific reasoning skill is one of the goals of science education (MEXT, 2008). I focus on scientific reasoning called “model based reasoning”, which is highly regarded in recent years. Model based reasoning is the reasoning that gives a new explanation/prediction of phenomena with existing scientific models (Nersessian, 1999). Recent years, acquisition of the metaknowledge of models (e.g. understanding the nature and purpose of models) is encouraged at scientific reasoning (Schwarz et al., 2009). This study focuses on and investigate the metaknowledge of scientific models and model based reasoning on lower secondary school students.

In this study, I prepared two students questionnaires. One of the questionnaires is 20-items pencil-and-paper questionnaire which requires participants to respond on a five-point scale to investigate students' cognition of metaknowledge of scientific models. The other is the questionnaire which requires participants to give explanation/prediction of phenomena with scientific models.

The questionnaires were administered to 89 college students. The results of this analysis revealed following: 1) Lower secondary school students don't understand that scientific models are useful for explanation/prediction of phenomena, scientific models have limitation for explaining phenomena, and scientific models are tentative. 2) Lower secondary school students can't explain phenomena related scientific models and don't understand how to use scientific models.

Based on the results of this analysis, science teachers have to let lower secondary school students realize that scientific models are tentative at scientific lessons. Lower secondary school students need to realize that scientific models are useful for explanation/prediction although models have limitation through using scientific models to explain/predict phenomena. Science teacher need to teach how to use scientific models and pay attention to a relationship between scientific models and scientific phenomena.