The following is my proposal to make a traditional presentation of my research project “Learning Chemistry in the Context of the History and Philosophy of Chemistry” at the 2014 Graduate Students’ Symposium. Thank you for considering this proposal,

Rick Wiebe

For over a hundred years, scientists educators and policy makers have encouraged the inclusion of the history and philosophy of science as best practice in the teaching of science (see for example, AAAS, 1993; Matthews, 1994). However, experimental evidence describing the benefits of the history and philosophy of science on learning of science concepts is limited or quite old and is not particularly convincing (Lederman, 2003).

The philosophy of chemistry is a relatively new discipline and as a result has not had a significant influence in the development of chemistry curricula. It then follows that there is little literature on learners’ perceptions and understanding of philosophical principles of chemistry. The present Manitoba chemistry curriculum is grounded mostly in learning theory and pedagogy, rather than the philosophy of chemistry, that is, providing learners with an understanding of what chemistry is, its processes and its history. As a result, the present curriculum is oriented more towards the understanding of concepts than the understanding of chemistry as a discipline of science. While the understanding of the concepts is important it is more beneficial if these concepts are learned in the context of understanding the history of chemistry and its nature. Given the orientation of the curriculum, the unit of study on gas behaviour from the Manitoba Grade 11 Chemistry curriculum has been redesigned using a grounding in the philosophy of chemistry and the historical development of the understanding of gas behaviour as its context.

The research project is seeking to answer the following questions:

1. Does a unit of study on gas behaviour using the philosophy of chemistry as a foundation and history as its context improve learners’ understanding of the nature of chemistry?
2. Does presenting concepts with a historical context improve learners’ conceptual understanding of gas behaviour?

Achievement and understanding have been differentiated here because achievement and understanding are not necessarily the same and can vary greatly depending upon the assessment method (Gabel, 1999).

3. Does teaching chemistry using history as a context improve learners’ achievement in chemistry?
4. Does the use of historical examples of controversy, conflict, explanation and argumentation influence learners’ ability to communicate scientifically?

This study adds to the body of literature that addresses the effects of the history and philosophy of science on learning the nature of science and science concepts, as well as the learners’ ability to communicate scientifically. This study also provides a possible framework for the development of chemistry curricula based upon improving learners’ understanding of the nature of chemistry and the concepts of chemistry.
The study collected data from a control group consisting of 65 grade 11 chemistry students from three suburban Winnipeg high schools and an intervention group consisting of 53 students from the same high schools. Both control and intervention groups were taught by the same three teachers. The control group was taught and assessed as the classroom teacher would normally. The intervention group was taught using a unit of study developed by the investigator. Students completed pre- and post-tests of the test for Conceptual Understanding in Chemistry and the Views on Chemistry and Education Questionnaire, as well as an achievement test at the completion of the unit. Data from these sources is being analyzed and cannot be reported in this proposal, but will be presented at the symposium.

References