

## **Research Plan: Improving the Teaching and Learning of Science Using Units of Historical Presentation**

Dr. Stephen Klassen (Physics) University of Winnipeg (principal investigator)

Dr. Barbara McMillan (Science Education) University of Manitoba

Dr. Donald Metz (Science Education) University of Winnipeg

Dr. Arthur Stinner (Science Education) University of Manitoba

### **Research Questions**

To what extent does an inquiry-rich science curriculum that links humanistic and scientific modes of thought influence student success in science and in the development of positive attitudes toward school science and the sciences, pure and applied?

To what extent does teachers' knowledge of the historical development of ideas in specific areas of the physical and chemical sciences contribute positively to their pedagogical growth and their attitudes toward science and the teaching of science?

### **Summary of Proposed Research**

More than a decade ago, science educators recommended that science curricula be made more socially relevant, exciting and honest, and that they make explicit connections to the humanities (Fensham, 1992; Bingle & Gaskell, 1994; Shymansky & Kyle, 1992). One way of addressing these recommendations builds upon the historical approaches begun by J.B. Conant in the mid-1900s and G. Holton and F. Wilson, the editors of *The Harvard Project Physics* series (1967). Arons (1989), Luhl (1990), Martin & Brouwer (1993), Stinner (1995), and others, suggested history-based storylines that not only relate to students' experiences, interests, and imaginations, but also help to make students aware of the epistemology of science and the nature of science while providing basic content knowledge and research skills. More recently, Stinner, McMillan, Metz, Jilek, and Klassen (2003) showed that a variety of forms of historical presentation (case studies, biographies, dramas, stories), consistent with curriculum, can be designed for learners of all ages. We intend to expand the UHP concept to include other forms of historical presentation (for example, historical replication and multimedia) in collaboration with colleagues in Germany. A reciprocal study of related curriculum between Manitoba and Germany will be involved. Building upon this work, we want to determine the effect of historical contexts on student success and interest in science and on the efficacy and attitudes towards science of generalist classroom teachers. Beginning with the spiral curriculum of Manitoba's Grade 3 to Senior 4 Science, we are developing units of historical presentation (UHPs) for levels where identical concepts (e.g., electricity, the Millikan oil-drop experiment) are the focus of the physical science topics, albeit at various levels of complexity. These UHPs will incorporate the historical development of the scientific ideas featured at the various levels and build upon the untutored ideas represented by the learners at each of the levels, Grade 3 through University 2, where the content is part of the curriculum. We will be field testing the UHPs to determine their effect on learners' attitudes toward science and success in science, using qualitative and quantitative methods. The second part of the study will focus on the professional development of teachers. Of particular interest is the development of early and middle years teachers who do not have a major or minor in science. The professional development will involve the teachers as learners in the UHPs designed for a specific concept and as participants in specialized conferences; for example, Grade 3 teachers who are expected to teach children about electrostatic forces and magnetism will learn how this knowledge was historically constructed and Senior 4 teachers will learn the history of the Millikan oil-drop experiment with a reconstruction of the original apparatus. It will then be determined how this knowledge affects their self-efficacy and attitude toward teaching science, and their students' learning (i.e., their success in school science) and interest in science.