Introduction

Background

The ***Kindergarten to Grade 4 Science: Manitoba Curriculum Framework of Outcomes*** (1999) (hereinafter referred to as the *Science Framework*) presents student learning outcomes for Kindergarten to Grade 4 science. These learning outcomes are the same for students in English, French Immersion, and Franco-Manitoban programs and result from a partnership involving two divisions of Manitoba Education and Training: School Programs and Bureau de l'éducation française. The Manitoba science student learning outcomes are based on those found within the *Common Framework of Science Learning Outcomes K to 12* (Council of Ministers of Education, Canada, 1997). The latter, commonly referred to as the *Pan-Canadian Science Framework*, was initiated under the Pan-Canadian Protocol for Collaboration on School Curriculum (1995), and was developed by educators from Manitoba, Saskatchewan, Alberta, British Columbia, the Northwest Territories, the Yukon Territory, Ontario, and the Atlantic Provinces.

> Student learning outcomes are concise descriptions of the knowledge and skills [and attitudes] that students are expected to learn in a course or grade level in a subject area. *(A Foundation for Excellence,* 1995)

This *Science Framework* provides the basis for teaching, learning, and assessing science, and is mandated for use in all schools (*A Foundation For Excellence*, 1995). In addition, this *Science Framework* serves as a starting point for future development of curriculum documents, support materials, learning resources, assessment tools, and professional development for teachers. *Kindergarten to Grade 4 Science: A Foundation for Implementation* (1999) complements this *Science Framework*, providing support for its implementation, including suggestions for instruction and assessment.

This *Science Framework* is organized into three sections:

- **Introduction** – describes the background, vision, goals, and beliefs upon which this *Science Framework* is based.
- **Manitoba Foundations for Scientific Literacy** – describes Manitoba foundations for scientific literacy, presents the conceptual organizer for Manitoba science education, and states the general learning outcomes that are broad descriptors of what Manitoba students are expected to know and be able to do as a result of their Early, Middle, and Senior Years science education.
- **Specific Learning Outcomes** – presents specific learning outcomes that describe the knowledge, skills, and attitudes that students are expected to demonstrate with increasing competence and confidence in science by the end of each grade.

Vision for Scientific Literacy

Global interdependence; rapid scientific and technological innovation; the need for a sustainable environment, economy, and society; and the pervasiveness of science and technology in daily life reinforce the importance of scientific literacy. Scientifically literate individuals can more effectively interpret information, solve problems, make informed decisions, accommodate change, and create new knowledge. Science education is a key element in developing **scientific literacy** and in building a strong future for Canada's young people.

This *Science Framework* is designed to support and promote the vision for **scientific literacy** as articulated in the *Pan-Canadian Science Framework*.

> The [Pan-Canadian Science] Framework is guided by the vision that all Canadian students, regardless of gender or cultural background, will have an opportunity to develop scientific literacy. Scientific literacy is an evolving combination of the science-related attitudes, skills, and knowledge. Students need to develop inquiry, problem-solving, and decision-making abilities, to become lifelong learners, and to maintain a sense of wonder about the world around them.
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> Diverse learning experiences based on the [Pan-Canadian Science] Framework will provide students with many opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment that will affect their personal lives, careers, and their future.
> (*Common Framework of Science Learning Outcomes K–12*, 1997)

Goals for Canadian Science Education

To promote scientific literacy, the following goals for Canadian science education were developed as part of the *Pan-Canadian Science Framework* and are addressed through Manitoba science curricula.

Science education will...

- encourage students at all grades to develop a critical sense of wonder and curiosity about scientific and technological endeavours
- enable students to use science and technology to acquire new knowledge and solve problems, so that they may improve the quality of their own lives and the lives of others
- prepare students to critically address science-related societal, economic, ethical, and environmental issues
- provide students with a proficiency in science that creates opportunities for them to pursue progressively higher levels of study, prepares them for science-related occupations, and engages them in science-related hobbies appropriate to their interests and abilities
- develop in students of varying aptitudes and interests a knowledge of the wide variety of careers related to science, technology, and the environment

Beliefs about Learning, Teaching, and Assessing Science

To promote scientific literacy among future citizens, it is crucial to recognize how students learn, how science can best be taught, and how learning can be assessed. Students are curious, active learners who have individual interests, abilities, and needs. They come to school with various personal and cultural experiences and prior knowledge that generate a range of attitudes and beliefs about science and life.

Students learn most effectively when their study of science is rooted in concrete learning experiences, related to a particular context or situation, and applied to their world where appropriate. Ideas and understandings that students develop should be progressively extended and reconstructed as students grow in their experiences and in their ability to conceptualize. Learning involves the process of linking newly constructed understandings with prior knowledge and adding new contexts and experiences to current understandings.

Development of scientific literacy is supported by instructional environments that engage students in the following processes:

- **scientific inquiry:** students address questions about natural phenomena, involving broad explorations as well as focussed investigations
- **technological problem solving (design process):** students seek answers to practical problems requiring the application of their science knowledge in various ways
- **decision making:** students identify issues and pursue science knowledge that will inform the issues

It is through these processes that students discover the significance of science in their lives and come to appreciate the interrelatedness of science, technology, society, and the environment.

Each of these processes is a potential starting point for approaching science learning. These processes may encompass a variety of learning approaches for exploring new ideas, for developing specific investigations, and for applying the ideas that are learned.

To achieve the vision of scientific literacy, students must increasingly become engaged in the planning, development, and evaluation of their own learning experiences. They should have the opportunity to work cooperatively with other students, to initiate investigations, to communicate their findings, and to complete projects that demonstrate their learning. To assist teachers in planning for instruction, assessment, evaluation, and reporting, Manitoba Education and Training recommends the following:

> At the beginning of a block of instruction, teachers and students identify expected learning outcomes and establish performance criteria. It is important that these criteria correspond with provincial [learning] outcomes.… This communication between students and teachers helps to identify clearly what needs to be accomplished, thereby assisting in the learning process.
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> When students are aware of expected outcomes, they will be more focussed on the learning and more likely to assess their own progress. Furthermore, they can participate in creating appropriate assessment and evaluation criteria. Assessment methods must be valid, reliable, and fair to students. (*Reporting on Student Progress and Achievement: A Policy Handbook for Teachers, Administrators, and Parents,* 1997)