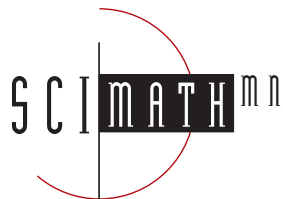


Minnesota K-12 Science Framework

Supporting standards-based science
education for all Minnesota students



SciMath^{MN} was formed in 1993 as a partnership among education, business and state government to pursue statewide improvement in the teaching and learning of mathematics and science. Its mission is to increase the participation and achievement of *all* Minnesota students in mathematics and science. Efforts are focused in three areas: Policy - advancing state and institutional policies that promote mathematical and scientific literacy for all students; Public Awareness - increasing public knowledge of and support for high standards and the importance of quality mathematics and science education for all students; and Professional Development - strengthening the preparation of new teachers and expanding the knowledge and skills of practicing teachers. For more information about SciMath^{MN}, contact Katie Bratsch, 612-296-4058, scimath-mn@informns.k12.mn.us.

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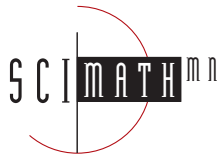
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Graduation Standards are current as of September 15, 1997. Consult the MN Department of Children, Families & Learning web site at <http://www.educ.state.mn.us>, check with your MEEP regional coordinator, or call 612-296-3308 for updates.

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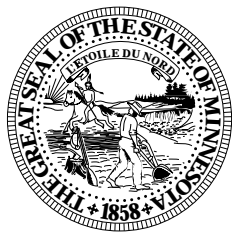
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“Science is a way of knowing that is characterized by empirical criteria, logical argument and skeptical review. Students should develop an understanding of what science is, what science is not, what science can and cannot do, and how science contributes to culture.”

NSES, P. 21

Preface

Soon after it was formed in 1993 as a statewide coalition for standards-based reform for K-12 science and mathematics education in Minnesota, SciMath^{MN} began a multi-year effort to write and produce state curriculum frameworks. The standards movement had already taken hold across the country, and in Minnesota a new scheme of performance-based high school graduation requirements was taking shape in the form of curriculum standards. The idea was to identify a common set of core concepts and skills which every Minnesota graduate should master. In science and mathematics, the Minnesota standards quickly came to reflect the content of the national curriculum standards. What was missing, however, was a document to identify the powerful overlap of national and state standards and to help schools and teachers translate those ideas into their own practice.

Thus, the *Minnesota K-12 Science Framework* (1997) produced by SciMath^{MN} in cooperation with the Minnesota Department of Children, Families & Learning is about standards and about connections. Working from the premise that having common standards and a coherent science program statewide will lead to improved student performance, the *Minnesota K-12 Science Framework* builds on the state standards to define the science content that all students should know and be able to do. The framework deliberately and graphically illustrates the connections between the national and state standards in science, showing the ways in which the key concepts of the standards can be translated into science programs at the district, building, and classroom levels.

This framework is also about connecting science content to instruction and assessment. Reflecting the importance of inquiry and problem solving in the *Minnesota Graduation Standards* overall, the *Minnesota K-12 Science Framework* focuses on the notion that learning science is an active process and that this emphasis on active learning should guide our choices of instructional strategies and assessment techniques. The framework offers detailed guidance—including vignettes and narratives—on what this form of instruction and assessment looks like in the classroom, for both student and instructor.

Just as importantly, this framework also provides guidance on ways to bring the entire science education program into alignment, so that our policies and practice reflect the coordination and coherence implied in “systemic” reform. Thus, although the chapter on content occupies a major portion of the document, there are also chapters detailing the best practices, connections among program components, professional development, and resources for teachers needed to achieve high quality science education for all students at every level of the K-12 system.

The *Minnesota K-12 Science Framework* is a “field guide” for implementing the *Minnesota Graduation Standards* in science, providing direction and support for stronger, more relevant science education for each one of our students. It does not dictate exactly how we get to the goal, but offers guidance on helpful options and alternatives. It also reminds us that effective teaching of science can happen only within a system of learning that is supported by consistent policies, sufficient resources, continuous improvement, and universal responsibility for achieving the vision. Those of us who are stakeholders—parents, community members, and others—can use the framework to better understand and appreciate the direction and support teachers need to achieve the vision in the standards.

Bill Linder-Scholer
Executive Director, SciMath^{MN}
September, 1997

What is a Framework?

A framework is a document that represents the best thinking about the knowledge, skills, and processes students should know, understand, and be able to do as a result of their education in a particular discipline. It reflects the policy and educational goals of the state and provides a structure for organizing the components of the instructional system. A framework is a tool that provides guidance for curriculum selection and development, instruction, and assessment at the local level. It is not intended to serve as a curriculum, but rather a guide, emphasizing what students should know and be able to do at various points as they move through the system.

“State curriculum frameworks can provide a common point of reference for state, district, and local educators to coordinate the many components of the instructional system.”

ASCD, 1992

A framework also provides direction in aligning curriculum, assessment, and instruction across the educational system and guidance for connecting all components of the educational system to improve student achievement. It can be used as a catalyst for professional development about creating teaching and learning environments, implementing instructional strategies, and selecting teaching resources that will maximize learning for all students.

The *Minnesota K-12 Science Framework* is a bridge between the National Research Council’s (NRC) *National Science Education Standards*, the *Minnesota Graduation Standards*, and classroom practice. It is designed to be used as a resource guide to support and encourage changes in curriculum, instruction, and assessment in K-12 science.

The Minnesota K-12 Science Framework:

- shows connections between the NRC *National Science Education Standards* and the *Minnesota Graduation Standards*.
- provides structure for making choices about curriculum, instruction, and assessment.
- provides descriptions of the best thinking and best practices in science education.
- provides direction for developing programs that include high standards and expectations for all students.
- provides direction to schools and districts while allowing them flexibility and delegating responsibility to those closest to students.

The *Minnesota K-12 Science Framework* is designed to be used in concert with the *National Science Education Standards* and the *Minnesota Graduation Standards*. It is a parallel document to the *Minnesota K-12 Mathematics Framework* and a companion to *Transforming Teacher Education*, SciMath^{MN}’s framework for mathematics and science pre-service teacher education.

This Framework

The *Minnesota K-12 Science Framework* includes seven chapters that, when used together, serve as a guide for planning, designing, and implementing standards-based science programs. Each chapter focuses on a different aspect of science education. When viewed as a whole, this document provides direction and support for improved science education for all students. Empowering the educational system to direct learning into the twenty-first century is its goal. Well prepared, life-long learners is its outcome.

Chapter 1: Overview

This chapter provides an overview of the entire document and a guide to using the *Framework*.

Chapter 2: Best Practice

This chapter summarizes some of the educational research that supports best practices in teaching, learning, and assessment in science education. It includes implications for the classroom and resources for further study.

Chapter 3: Content & Instruction

This chapter gives direction for the content and instruction that should be a part of every science program. The *National Science Education Content Standards* and the *Minnesota Profile of Learning* are laid side by side, along with classroom vignettes that exemplify the standards and narratives that provide a focus for instruction. It is intended to be used in planning and designing K-12 science curriculum.

Chapter 4: Connections

This chapter provides direction for making connections among the science disciplines, to other disciplines, to the work world, and to everyday life as science content is taught and learned.

Chapter 5: Professional Development

This chapter provides an overview of the current research and thinking on standards-based professional development.

Chapter 6: Resources

This chapter provides selected information regarding resources for teaching science at all levels. Direction for curriculum and program development, as well as information and resources related to technology, safety, and other issues connected to science education, is also included.

Chapter 7: Making it Happen

Educational reform is the responsibility of many people and organizations. This chapter includes information and direction for building capacity for standards-based systemic change.

