

Overview

“An understanding of science makes it possible for everyone to share in the richness and excitement of comprehending the natural world. Scientific literacy enables people to use scientific principles and processes in making personal decisions and to participate in discussions of scientific issues that affect society. A sound grounding in science strengthens many of the skills that people use every day, like solving problems creatively, thinking critically, working cooperatively in teams, using technology effectively, and valuing life-long learning. And the economic productivity of our society is tightly linked to the scientific and technological skills of our workforce.”

Chapter 1: Overview

This is an important and exciting time in science education. Not since the Sputnik era has there been such lively discussion, compelling debate, and broad consensus about what should be taught and learned in K-12 science. Forty years ago, the focus of science reform was on creating science education programs for those who would pursue careers in science and engineering, although an important side benefit was improvement in science curriculum in general. The emphasis in this reform is on “science for all.” Unlike previous reforms, the science education community has sought and reached a surprising consensus on what should be taught and learned.

Science education reform in the nineties is in a broader context than that of forty years ago. This time, science education has been placed in a systemic framework. There is an understanding that quality science education involves not only establishing the appropriate content to be learned, but that this content must be delivered in programs that include exemplary teaching, appropriate professional development, new kinds of assessments, and supporting policies at both the local and state levels. Quality science education includes not only teachers, scientists, and researchers, but also the business community, parents, school administrators, policy makers, and others who influence the education system. Working collaboratively, these stakeholders can improve an educational system to provide more challenging learning opportunities and increased expectations in science for all students.

The National Research Council’s (NRC) *National Science Education Standards* and the American Association for the Advancement of Science’s (AAAS) *Project 2061 Science For All Americans* and *Benchmarks for Science Literacy* have defined a compelling vision for science literacy and laid the groundwork for the design of curriculum, assessment practices, the implementation of exemplary science teaching, and the incorporation of science content which is accessible to all students. In addition, these reforms are supported in Minnesota by a dramatic change in public education through the implementation of the *Minnesota Graduation Standards*.

The NRC’s *National Science Education Standards* (NSES) were developed with the input of over 1000 teachers, scientists, and educators nationwide. This consensus document is the foundation for the development of standards-based science programs in Minnesota. The *Minnesota K-12 Science Framework* is designed to link the *National Science Education Standards* and the *Minnesota Graduation Standards* with classroom practice.

We Believe...

The *Minnesota K-12 Science Framework* represents the collective wisdom of over one hundred Minnesota science educators, K-16. Through a series of writing and review conferences, this document evolved into what it is today. Five beliefs about science education provided the foundation for its development. These beliefs, grounded in research and practice, served as guiding principles for the developers of the *Framework*. It is our hope that these beliefs will continue to guide science education in Minnesota into the next century.

We Believe . . .

A. All students should be provided with the opportunity to learn rigorous science.

B. Standards-based education and the *National Science Education Standards* can contribute to building the capacity to improve curriculum, instruction, and assessment in Minnesota's K-12 schools.

C. Learning science is an active process.

D. Teachers are central to achieving excellence in science education.

E. Everyone has a role in improving and sustaining quality science education.

A. All students should be provided with the opportunity to learn rigorous science.

An understanding of science is essential for everyone. We believe all students, regardless of age, gender, cultural or ethnic background, income level, disabilities, aspirations, interest, or motivations, are capable of understanding the science content described in the *National Science Education Standards*, as well as participating in full scientific inquiry experiences. We believe that all students must be provided multiple opportunities over several years to learn and experience science.

B. Standards-based education and the *National Science Education Standards* can contribute to building the capacity to improve curriculum, instruction, and assessment in Minnesota's K-12 schools.

Standards-based education is fundamental to improving science education. We believe that standards provide consistent direction for curriculum, instruction, and assessment, and provide criteria on which to judge achievement and opportunities for students to learn. We believe that setting clear, high standards will contribute to the improved achievement of all students in science education.

C. Learning science is an active process.

Scientific inquiry is central to learning science. We believe that all students must learn the content of science through varied, direct experiences that provide them with the opportunities to actively explore the natural world and make connections to their prior knowledge. We believe that learning science requires interaction among peers, teachers, and scientists in the context of the broader community.

D. Teachers are central to achieving excellence in science education.

What happens in the classroom between teacher and student is the single most important element in the education system. We believe that implementation of improved curriculum, instruction, and assessment is possible with committed and knowledgeable teachers. We believe that teachers must be supported throughout their careers with meaningful professional development opportunities and appropriate resources in order for improvement to be lasting and substantial.

E. Everyone has a role in improving and sustaining quality science education.

Everyone has a stake in the improvement of science education. We believe that everyone must take responsibility for developing and maintaining learning communities that support improved science education for all students. We believe that all voices and their diverse viewpoints must be involved in the discussion, development, and implementation of policies that promote equity and excellence in science education.

Who Should Use This Framework?

While the *Minnesota K-12 Science Framework* has been designed for teachers of science, all those involved in science curriculum, assessment, and instruction in Minnesota's K-12 schools will find it useful. Improvement in science education cannot occur without the support of all those with a stake in the education of our students. This includes teachers, school administrators, curriculum specialists, professional development committees and coordinators, school boards, parents, higher education, business and community members, and state policy makers. Below are some examples of how this document may be used.

Teachers

- Align content standards and supporting curriculum with the *Minnesota Graduation Standards* and the *National Science Education Standards*.
- Develop, advocate, and use best practices in curriculum, instruction, and assessment.
- Translate standards into classroom practices that enable all students to achieve at high levels.
- Work to build an equitable K-12 curriculum that supports and promotes quality science education for all students.
- Collaborate with educators statewide to promote science education as described in the *Framework*.
- Identify resources and build communities of learners that will support and sustain quality science education programs.
- Develop and carry out a personal professional development plan that includes engagement in inquiry into practice, supports the ability to work with diverse learners, and models and promotes life-long learning.

School Administrators

- Develop an understanding of the components necessary for a quality, standards-based science program.
- Support and promote policies and allocate resources that enable the vision of the *Framework* to be realized.
- Support the development and implementation of coherent, standards-based science curriculum, instruction, and assessment that meets the needs of all students.
- Plan and promote professional development that engages teachers in active inquiry into their practice and models and promotes life-long learning.
- Incorporate the *Framework* into supervision and evaluation processes.

Curriculum Specialists

- Develop and implement coherent, standards-based science curriculum and assessment that meets the needs of all students.
- Promote discussion and development of effective instructional practices and assessment.
- Create and provide professional development opportunities consistent with the *Framework* and the needs of teachers.

Professional Development Committees & Coordinators

- Plan and promote professional development that engages teachers in active inquiry into their practice and models and promotes life-long learning.
- Create and provide professional development opportunities consistent with quality science education for all students and the needs of teachers.

Local School Boards

- Develop an understanding of the dynamic interconnectedness of curriculum, instruction, and assessment and the ongoing support required to institute and sustain standards-based science programs for all students.
- Adopt and support policies that help move the school system toward state and national standards in science as described in the *Framework*.
- Provide support for the resources necessary for instructional materials, appropriate assessment, and continuing professional development.
- Build partnerships with business and higher education institutions to support standards-based science education.

Parents

- Provide support and encouragement for the hands-on/minds-on science described in the *Framework*.
- Advocate for the resources necessary for science education as envisioned in the *Framework*, including instructional materials, appropriate assessment, and continuing professional development.
- Work with local educators to develop curriculum and assessment that reflects the standards and vision of the *Framework*.
- Participate in curriculum and assessment activities that model the standards and vision of the *Framework*.

College & University Educators

- Incorporate the *Framework* into programs that prepare future teachers.
- Collaborate with local school systems to provide and support standards-based professional development opportunities for science educators.
- Model practices which promote quality science education in higher education.
- Inform and facilitate articulation between K-12 and higher education.

Business & Community Members

- Collaborate with schools to support standards-based science programs for all students.
- Work with local educators to develop curriculum and programs reflecting the *Framework's* standards and vision.
- Align corporate outreach and volunteer programs with the vision of science education in the *Framework*.
- Build partnerships with schools that support standards-based science education.
- Provide examples of business and community applications of science concepts.

State Policy Makers

- Develop and support policies which advance quality standards-based science education for all students.
- Develop licensure and re-certification requirements that support the vision of the *National Science Education Standards* and the *Framework*.
- Develop an understanding of the dynamic interconnectedness of curriculum, instruction, and assessment, and provide the ongoing support required to institute and maintain quality science programs for all students.

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