

Connecticut State Board of Education
Hartford

Position Statement on Science Education

Adopted September 3, 2008

The Connecticut State Board of Education regards scientific literacy as evidence of a high-quality science education. People who are scientifically literate understand core science concepts of life, earth and physical science; use scientific reasoning; and recognize the interactions among science, technology and society. Science education teaches students to raise questions, to persevere in search of answers, to reason logically, and to distinguish between unsubstantiated claims and those that have valid and reliable substantiation. All students need opportunities to refine and strengthen their scientific content knowledge and scientific inquiry skills on a continuum from preschool through high school and beyond.

The Board believes that Connecticut's schools must increase their efforts to motivate and prepare more students to pursue science-related careers. The future of Connecticut's place in a globally competitive market relies on the engagement of students in pursuing innovative careers in science, technology, engineering and mathematics. By ensuring that every student learns science in a way that is intellectually engaging and contextualized in real-world experiences, schools can open new opportunities for students who otherwise may not see how prominent science is to solving the great challenges of this century. In addition, science education fosters students' natural curiosity about the world they live in and deepens students' understanding about their roles as stewards of the planet.

To accomplish these goals, the Board supports an inquiry-based approach to science education, which includes hands-on laboratory experiences for all students. Adequate time and appropriate resources must be provided for this specialized instruction. It is important to engage students in science investigations that foster students' natural curiosity and that provide opportunities for learning experiences to extend into the community.

Teachers play a critical role in helping students to learn the methods of science, how to make sense of data, and how to communicate and critically evaluate information. As part of a quality science program, all students must be held to expectations of high achievement as defined in the *Connecticut Core Science Curriculum Framework*. Science instruction should prepare students for mastery of content and include regular assessments.

Partnerships among families, school districts, community organizations, businesses and universities are necessary to fulfill this vision of science education as preparation for life, advanced studies and technical careers. In short, all concerned with maintaining a knowledgeable, informed citizenry must contribute expertise, resources, guidance and sustained support. To support this collaborative effort, the Board has developed "Guidelines for Policymakers," a set of recommendations that describe suggested roles and responsibilities for establishing a high-quality science education program.

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Components of a High-Quality PK-12 Science Education System: Guidelines for Policymakers

September 3, 2008

The Connecticut State Board of Education, in its 2008 Position Statement on Science Education, calls for a systematic approach to ensuring that every student in Connecticut receives a rich and coordinated PK-12 education in science. Science learning should focus simultaneously on developing an understanding of core concepts, as well as knowing how scientists work collaboratively to test ideas, analyze evidence and solve problems.

The realization of this vision is critical for our students' futures, as well as for Connecticut's place in the globally competitive economy. The Board offers the following guidelines to support the establishment of collaborations among various stakeholders to build a coordinated science education system.

Responsibilities of the Department of Education

- Develop and publish PK-12 science curriculum standards that clearly identify a sequenced progression of key science concepts and abilities that all students should develop.
- Develop student assessments that are aligned to the expected performances in the *Connecticut Core Science Curriculum Framework*.
- Provide current and accurate safety information for science teachers and building administrators.
- Provide appropriate professional development opportunities for science educators.
- Partner with higher education institutions, business and industry to strengthen science instruction and student interest in science, technology, engineering and mathematics (STEM) career paths.
- Ensure that science educators at all grade levels hold the appropriate teaching certificate for their assignment.
- Develop model curriculum aligned with the science framework for the core secondary science courses.

Responsibilities of School Districts

- Develop and implement a coherent and coordinated district science curriculum that is aligned with learning expectations set forth in the *Connecticut Core Science Curriculum Framework*.
- Provide a safe, effective learning environment at all grade levels and, when appropriate, grade-level laboratory or combination classroom/laboratory space based on the laboratory occupancy load limit.
- Provide instructional materials, supplies, technology and equipment, including safety equipment, storage space and a range of reading materials to support learning science through inquiry.
- Provide students access to science content and coursework through distance learning programs and technologies.
- Establish science safety policies, including a chemical hygiene plan, and appoint a chemical hygiene officer to implement and enforce the plan.
- Provide ongoing professional development in science content, pedagogy, safety and interdisciplinary instruction.
- Employ "highly qualified teachers" who are knowledgeable about the content, methods and pedagogy of the science they teach.
- Provide science teacher leaders to coordinate and support science instruction at all grade levels.
- Provide time for teachers to collaborate and develop rich science lessons, inquiry investigations and assessments that monitor student achievement in science.

- Provide time for teachers to set up and clean up science instructional materials.
- Inform families about the science curriculum, instructional methods and expectations for student learning.
- Encourage community participation in science events during and beyond the school day to promote the importance of scientific literacy and encourage student interest in science.

Elementary Grades

- Ensure that the instructional focus for science is comparable to that provided for language arts and mathematics, and that teachers are able to integrate literacy and numeracy instruction within the context of students' science learning experiences.
- Maintain class sizes that ensure instructional excellence and the safety of the students and the teacher.
- Provide indoor and outdoor science learning areas, including rooms with flat, movable desks or tables and chairs, appropriate science equipment, storage space and access to water and electricity as needed.
- Provide students with multiple opportunities every week to experience inquiry investigations that develop students' abilities to question, explore, observe, gather simple data, create graphs, draw conclusions based on the data and build their understanding of natural phenomena.
- Provide science enrichment opportunities to foster student interest in science.

Middle Grades

- Ensure that instructional time for science is comparable to that provided for language arts and mathematics.
- Maintain class sizes that do not exceed 24 students to ensure instructional excellence and the safety of the students and the teacher, as recommended by the national science teachers association (NSTA, 2007).
- Ensure that 80 percent of science instructional time is devoted to inquiry-based laboratory and/or field investigations (NSTA, 2003).
- Provide investigations that develop students' abilities to work collaboratively to formulate questions; develop experimental procedures; and collect, graph and analyze data using the appropriate tools, models and technology.
- Provide opportunities for students to explore careers in science.
- Encourage students to participate in science competitions and enrichment activities.

High Schools Grades

- Ensure that students have access to science instruction every semester with multiple opportunities to conduct laboratory and field investigations using the appropriate technology.
- Maintain class sizes that do not exceed 24 students to ensure instructional excellence and the safety of the students and the teacher, as recommended by the national science teachers association (NSTA, 2007).
- Ensure that 80 percent of science instructional time is devoted to inquiry-based laboratory and or field investigations (NSTA, 2007).
- Provide investigations that develop students' abilities to work collaboratively to formulate questions; develop experimental procedures; and collect, graph and analyze data using the appropriate tools, models and technology.
- Ensure that science teachers are assigned to one room for safety purposes and that science laboratories/classrooms are not used for instructional purposes outside the content area.

- Offer the broadest possible range of science courses and research opportunities that allow students to continue to develop their abilities to design laboratory investigations; understand measurement error; troubleshoot problems with equipment; and collect, interpret and present data.
- Ensure access to Advanced Placement courses, as well as other opportunities to interact with college-level curriculum.
- Encourage students to participate in science competitions and enrichment activities.
- Provide opportunities for students to explore careers in science and assure they receive adequate counseling to pursue those careers.

Responsibilities of Teachers

- Plan and implement instruction to support student understanding of science concepts, the nature of science and the relevance of science to personal and societal issues.
- Provide frequent and varied opportunities for students to read and write about science.
- Comply with safety regulations and prudent practices in the laboratory setting.
- Embed mathematics and language arts in science lessons and investigations.
- Stay current in science content and pedagogy.
- Provide varied assessments and use the results to inform instruction.
- Collaborate with peers to improve science education for all students.

Responsibilities of Higher Education Institutions

- Ensure science education candidates have a program of study that is rigorous in science content and pedagogy and aligned with the *Connecticut Core Science Curriculum Framework*.
- Provide teacher candidates with opportunities to practice science instruction in urban, suburban and rural schools.
- Model the inquiry process in the higher education classroom and use exemplary instructional materials.
- Model and emphasize science safety in all science courses.
- Provide collaborative experiences for teacher candidates to learn how to use data to inform instruction.
- Ensure teacher candidates are placed with master teachers/mentors for each student teaching assignment.
- Partner in the ongoing professional development of experienced teachers in science content, how students learn and effective instructional strategies.
- Provide incentives for faculty participation in PK-12 science education reform.

Opportunities to Support Science Learning for Families and Community Members

- Encourage students' interest in learning science by talking with children about the science they are learning at school and how it relates to daily life.
- Work with teachers to support students' learning in science.
- Provide science-related learning experiences such as taking children on nature walks and visiting museums, zoos, aquariums and nature centers.
- Encourage students to pursue advanced science courses, extracurricular experiences and science-related careers.
- Provide support to the school science program through actions such as attending science-related events, assisting with science activities, chaperoning field experiences or sharing expertise.

Opportunities to Support Science Learning for Business and Industry Stakeholders

- Be advised about and engage students and families in community-based activities that support and extend students' science knowledge and demonstrated interest.
- Develop ongoing and systematic partnerships with schools to support and enhance the science program and generate student interest in science and science-related careers.
- Provide mentoring and internships for teachers and students, grants for purchasing inquiry instructional materials and science equipment, "scientist in the classroom" visits and career pathway consultations.
- Support affordable access to community-based science institutions.
- Align initiatives to support state curriculum standards.
- Provide science enrichment experiences after school, on weekends, during school holidays and during the summer.
- Circulate specialized equipment and materials by providing loaner kits to schools.
- Collaborate with teachers to develop learning units aligned with state standards.
- Provide professional development for teachers and support to families.

Opportunities to Support Science Learning for Museums, Zoos and Other Public Science Resource Institutions

- Be advised about and engage students and families in community-based activities that support and extend students' science knowledge and demonstrated interest.
- Develop ongoing and systematic partnerships with schools to support and enhance the science program and generate student interest in science and science-related careers.
- Provide mentoring and internships for teachers and students, grants for purchasing inquiry instructional materials and science equipment, "scientist in the classroom" visits and career pathway consultations.
- Support affordable access to community-based science institutions.
- Align initiatives to support state curriculum standards.
- Provide science enrichment experiences after school, on weekends, during school holidays and during the summer.
- Circulate specialized equipment and materials by providing loaner kits to schools.
- Collaborate with teachers to develop learning units aligned with state standards.
- Provide professional development for teachers and support to families.

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Glossary

laboratory occupancy load: Number of occupants allowed in the laboratory setting based on the National Fire Protection Association (NFPA) and the International Code Council (ICC) based on 50 square feet net per occupant in the lab, or 60 square feet net per occupant in a combination lab/lecture room with a maximum of 24 students providing the legal occupancy load is not violated.

scientific inquiry: The process by which scientific knowledge is created, communicated and evaluated.

teacher leader: Any teacher serving as an instructional coach, mentor, teacher leader, team leader, content coach or curriculum specialist, but not responsible for evaluation of staff or other administrative responsibilities.

References

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