


[siteSearch](#)
[NSTAHome](#)
[yourClassroom](#)

- elementary school
- middle school
- high school
- college

[aboutNSTA](#)
[yourMembership](#)
[NSTANews](#)
[NSTACalendar](#)
[teacherResources](#)
[professionalInfo](#)
[NSTAConventions](#)
[NSTACommunity](#)
[otherVisitors](#)
[scienceStore](#)

TeacherResources

NSTA Position Statements

NSTA Standards for Science Teacher Preparation

The following are NSTA's standards for preparing the nation's pre-service science teachers, regardless of the grade level.

- I: Core Standards for *All Pre-Service* Teachers of Science
- II: Standards for *Elementary* Science Teacher Preparation
- III. Standards for *Middle Level* Science Teacher Preparation
- IV. Standards for *High School* Science Teacher Preparation

I: Core Standards for *All Pre-Service* Teachers of Science

Introduction

Recent demands for education reform, particularly science education, are spawned by increased concerns about declining performance of our nation's K-12 students, international economic competition and recognition that our society is increasingly dynamic, complex and ethnically diverse. The construction of knowledge about teaching and learning is evolving faster than institutions and bureaucracies can respond. NSTA recognizes that science teachers exercise key roles in implementing effective reforms. These standards are designed to insure that teachers will be able to accomplish this task.

Sub-categories

Teacher Resources

[Awards](#)
[Careers](#)
[Competitions](#)
[Curriculum Kit: Science and Our Food Supply](#)
[Evolution Resources](#)
[Grants](#)
[NSTA Journals](#)
[NSTA Press](#)
[NSTA Recommends](#)
[NSTA Reports!](#)
[Position Statements](#)
[Read It](#)
[Science Store](#)
[Science Websites](#)
[SciLinks](#)
[SS&C Micro-Units](#)
[Suppliers](#)
[Teachers' Grab Bag](#)

1. Programs designed to prepare science teachers should enable them to:
 - Provide students with a holistic understanding of science, minimizing the rigid boundaries among the sciences and emphasizing the interconnections with other subject areas.
 - Engender positive attitudes in K-12 students toward science and science teaching.
 - Emphasize current science and technology issues and the relationships among ideas, disciplines and phenomena.
 - Motivate K-12 students to become long-term learners of science.
 - Reflect on their teaching practices and enable K-12 students to become reflective learners.
 - Engage all K-12 students in the study of science, providing for differences in gender, disability, socioeconomic background, culture, ethnic membership and academic ability.
 - Align their curriculum with local, state and national guidelines.
 - Use assessment tools which are aligned with instruction and consistent with contemporary goals of assessment.

2. Programs for science teacher preparation should:
 - Model the type of teaching and learning expected in exemplary science classrooms at all grade levels
 - Involve collaborative planning among all stakeholders (scientists, science teacher educators and others) so that science and science methods components are mutually reinforcing.
 - Be based on sound contemporary scientific and educational research.

Field and Classroom Experiences

Opportunities to teach science to K-12 students of various backgrounds and abilities must be an integral part of teacher preparation. These opportunities should be incorporated into each of several semesters in conjunction with course work, particularly methods courses.

1. Field and classroom experiences should occur in a variety of school settings, reflecting different ethnic and cultural backgrounds and should:
 - Begin early in the program.
 - Progress toward higher levels of teaching responsibility.
 - Culminate in full classroom responsibility during student teaching.
 - Involve collaborative planning between university personnel, school administrators and the classroom teachers supervising the field experiences.

Examples of effective classroom and field experiences might include supervised observation, tutoring, laboratory activities, small and large group instruction and use of community resources.

2. Student teaching experience should:
 - Include full-time teaching for at least 10 weeks and with specific experience in all science subjects for which initial certification will be sought.
 - Provide pre-service teachers experience with a full range of in-school activities and responsibilities.
 - Provide time to plan and conduct science instruction for students at the appropriate grade level(s).
 - Involve regular supervision by a qualified classroom science teacher (cooperating teacher) and a university science educator.
 - Involve regular seminars linking theory to practice.

University/College Faculty

1. Faculty assigned to teach science methods courses for the professional development of pre-service science teachers should:
 - Model effective teaching strategies.
 - Have science teaching experience at the level for which they are teaching or have demonstrated expertise in working with students and teachers at that level.
 - Provide a stimulating learning environment that results in high quality instruction, including positive attitudes toward science and science teaching.
 - Have strong preparation in the sciences, as well as science education.
 - Utilize outstanding classroom teachers as resource persons.

2. Faculty assigned to teach science courses for the professional development of pre-service science teachers should:
 - Model effective teaching strategies.
 - Provide a stimulating learning environment that results in high quality instruction, including positive attitudes toward science and science study.
 - Have strong, appropriate science preparation.

Facilities, Equipment and Materials

All pre-service teachers should receive their instruction in facilities which include equipment, instructional materials, and laboratory resources that promote science learning. Pre-service teachers should work with typical materials, equipment and supplies used in classrooms at the level they are planning to teach.

Instructional Technology

The use of educational technologies should be modeled so that pre-service teachers will know how and when to use them effectively in science teaching.

Supportive Preparation in Mathematics

Programs should provide pre-service teachers with:

- Knowledge of mathematics, as specified for the level of preparation.
- Knowledge of applications of statistics consistent with the subject matter discipline and the level(s) they will teach.
- An understanding of the inter-relationships between mathematics and science.
- Data analysis skills, including graphing and data display.

Professional Orientation

Programs designed to prepare science teachers should include experiences that:

- Provide information and promote membership in professional organizations for science teachers.
- Develop the capacity and motivation to become life-long learners of science and science education.
- Foster an appreciation for the value of science in the total curriculum and in the lives of K-12 students.
- Promote the use of professional publications, journals and other resources for science teachers.
- Foster an appreciation for human diversity.

II: Standards for *Elementary Science* Teacher Preparation

Science Teaching Preparation

The program should require substantial experience in the study of elementary school science teaching methods. Pre-service elementary science teachers must be provided with experiences, materials, and skills which will enable them to:

- Provide all elementary students with a holistic

and interdisciplinary understanding of science.

- Understand the ways in which young children learn science.
- Work with students of different ethnic and cultural groups.
- Understand the professional and legal obligations of science teaching.
- Integrate science instruction across the curriculum.
- Select science concepts that are developmentally appropriate.
- Provide for the selection and use of a variety of instructional strategies and materials.
- Provide elementary students with active (hands-on) learning activities conducive to the development of scientific processes and critical-thinking skills.
- Relate science to contemporary events, research results, and the elementary students' daily lives.
- Use classroom management techniques to establish an environment conducive to learning science.
- Use techniques for assessing elementary student outcomes which are aligned with instruction and consistent with contemporary assessment goals.
- Plan instruction based on elementary students' prior knowledge, conceptualizations and misconceptions.
- Identify, establish and maintain safety in all areas related to science instruction.
- Use electronic educational technology (computers, interactive video, telecommunications technology, etc.) in teaching science.

A minimum of 3 semester hours of elementary science education course work is recommended to accomplish these outcomes.

Science Preparation

Programs should require laboratory and field-oriented experiences in the biological, earth/space, environmental, life and physical sciences. Science

courses should be designed or chosen specifically to serve the needs of pre-service elementary school science teachers. Science course work should enable teachers to:

- Provide all elementary students with a holistic and interdisciplinary understanding of concepts in earth/space, environmental, life and physical sciences.
- Understand the relationships among science, technology, society, human issues and cultural values.
- Use science processes, including investigating scientific phenomena, interpreting findings, and communicating results.
- Promote competency among elementary students in selected laboratory and field skills.
- Use decision-making and value-analysis skills to investigate science-related societal problems.
- Apply basic mathematics and computer skills to the scientific investigation of phenomena and analysis of data.

A minimum of 12 semester hours in science courses is recommended to accomplish these outcomes.

III. Standards for *Middle Level Science* Teacher Preparation

Science Teaching Preparation

Middle level science teacher education programs should require substantive experience in middle level science teaching which emphasizes the unique intellectual, physical, social and emotional development of the early adolescent. Professional courses for pre-service middle level science teachers should model the exemplary teaching behaviors and teaching skills which will enable them to:

- Provide all middle level students with a holistic and interdisciplinary understanding of science.
- Understand the professional and legal

obligations of science teaching.

- Work with students from different ethnic and cultural groups.
- Provide experiences that will promote the use of science processes and problem solving skills.
- Plan instruction based on middle level students' prior knowledge, conceptualizations and misconceptions.
- Use a variety of instructional strategies, curriculum materials, and equipment in an active (hands-on) learning environment.
- Use techniques for assessing middle level student outcomes which are aligned with instruction and consistent with contemporary goals of assessment.
- Relate science to contemporary events, research results, and the middle level students' daily lives.
- Apply to science teaching the current research findings on early adolescents learning.
- Use classroom management techniques to establish an environment conducive to learning science.
- Identify, establish and maintain safety in all areas related to science instruction.
- Use electronic educational technology (computers, interactive video, telecommunications technology, etc.) for teaching science.
- Integrate science with other middle school subjects.

A minimum of 3 semester hours of middle level science education course work is recommended to accomplish these outcomes.

Science Preparation

A program for middle level science teachers must provide instruction in science and at least one other teaching field, such as health, language arts, social science or mathematics. Science course work for pre-service middle level teachers should enable them to:

- Provide a holistic and interdisciplinary understanding of concepts in life, earth/space, physical and environmental sciences.
- Understand the relationships among science, technology, society, human issues and cultural values.
- Use the science processes, including investigating phenomena, interpreting findings, communicating results, and making judgements based on evidence.
- Develop a broad range of research, laboratory and field skills.
- Use decision-making and value-analysis skills to investigate science-related societal problems.
- Apply basic mathematics and computer skills to the scientific investigation of phenomena and analysis of data.

A minimum of 24 semester hours of science course work is recommended to accomplish these outcomes.

IV. Standards for *High School Science* Teacher Preparation

Science Teaching Preparation

Instruction in science teaching methods for pre-service high school teachers should be specifically related to the teaching and learning of science. Experiences should be based on research, planned collaboratively with professionals in education, science and science teaching, and include applications in classroom settings. This preparation should enable pre-service high school science teachers to:

- Provide all high school students with a holistic and interdisciplinary understanding of science.
- Understand their professional and legal obligations, and liabilities for maintaining a safe environment.
- Work with students from different ethnic and cultural groups.

- Relate science to current events, research results, and the high school students' daily lives.
- Adapt instructional approaches to the needs of a wide range of learner abilities, backgrounds and goals.
- Use a variety of instructional strategies, science curriculum and community resources.
- Design and implement laboratory and field-based learning activities.
- Use alternative techniques for assessing high school student outcomes which are aligned with instructional goals and consistent with contemporary assessment goals.
- Engender in high school students the use decision-making and value-analysis skills required to explore relationships and issues in science, technology, society, human issues and cultural values.
- Use classroom management techniques to establish an environment conducive to learning science.
- Apply contemporary research findings to the teaching and learning of science.
- Provide career opportunity information for science fields.
- Establish and maintain safety in all areas where science instruction occurs.
- Plan instruction based on high school students' prior knowledge, conceptualizations and misconceptions.
- Apply basic statistical methods and processes of data analysis to science teaching.
- Use electronic educational technology (computers, interactive video, telecommunications technology, etc.) for teaching science.

A minimum of 3 semester hours of science education course work is recommended to accomplish these outcomes.

Science Preparation

Science preparation must meet the standards set forth under the science discipline/areas (listed

below) and should enable teachers to:

- Develop proficiency in using the science processes, including investigating phenomena, interpreting findings and communicating results.
- Provide students with competency in using a broad range of research, laboratory and field skills.
- Provide knowledge of scientific concepts and principles and their applications to technological and societal issues.
- Develop decision-making and value- analysis skills needed for addressing science-related societal problems.
- Provide a holistic and interdisciplinary understanding of earth/space, environmental, life, and physical sciences.

Common Models for Science Field Course Work

Single-field, dual-field and broad-field preparation are three common models for science course work in pre-service science teacher education programs. NSTA recognizes that teachers in small schools may be required to teach in several fields. Therefore, NSTA makes the following recommendations for course work in each model. The term primary science discipline(s) in this document refers to any or all of the following: biology, chemistry, earth/space sciences and physics.

1. **Single-field model** - involves a concentration in a primary discipline. Single-field preparation should include a minimum of 32 semester hours of credit in a major field, with 16 hours distributed in the remaining three primary science fields is recommended. Physical science and general science are treated as single fields. For physical science, 30 hours distributed between chemistry and physics, 12 hours of earth science and 6 hours of biology are recommended. For general science, an equal distribution of 48 hours among the four primary fields is recommended.

2. **Dual-field model** - prepares teachers to teach in two primary disciplines. The dual-field model should include a minimum of 24 semester hours in each of two primary fields. An additional 6 hours should be distributed between the remaining primary disciplines.
3. **Broad-field model** - prepares teachers to teach in all four primary disciplines. A broad-field preparation should include at least 24 hours in one primary discipline, 15 hours in each of two other primary disciplines, and nine hours in the remaining primary discipline.

Note that *all models must meet the core standards above for pre-service high school science teacher preparation and the discipline/area standards listed below for the subjects in which they are to be certified.* [For example, a broad-field preparation in biology, chemistry, earth/space sciences and physics should meet the standards under each discipline.]

Discipline/Area Preparation

1. Preparation to Teach Biology/Life Science:

In addition to meeting the core program standards, preparation should enable biology teachers to:

- Understand and develop the major concepts and principles of biology, included in anatomy, physiology, ecology, behavior, evolution, genetics, cell/microbiology, diversity, growth and human biology.
- Develop understandings of the inter-connectedness of the sciences and relate the major concepts of chemistry, physics and earth/space to the teaching of biology.
- Apply mathematics, including basic statistics and pre-calculus, to investigations in biology, including the analysis of data.
- Relate the study of biology to contemporary, historical, technological and societal issues.

- Locate appropriate resources, design and conduct inquiry-based, open-ended investigations in biology, interpret findings, communicate results and make judgments based on evidence.
- Use and care for living organisms in an ethical and appropriate manner.

2. Preparation to Teach Chemistry: In addition to meeting the core program standards, preparation should enable chemistry teachers to:

- Understand and develop the major concepts and principles of chemistry, including the properties of matter, solutions, reaction chemistry, chemical energetics and the kinetic molecular model (The program should include courses in inorganic, organic, analytical, physical and biochemistry).
- Develop understandings of the interconnectedness of the sciences and relate the major concepts of biology, earth/space sciences and physics to the teaching of chemistry.
- Apply mathematics, including calculus, to investigations in chemistry, including the analysis of data.
- Relate the study of chemistry to contemporary, historical, technological and societal issues.
- Locate appropriate resources, design and conduct inquiry-based, open-ended investigations in chemistry, interpret findings, and communicate results, and make judgments based on evidence.

3. Preparation to Teach Earth/Space Science: In addition to meeting the core program standards, preparation should enable earth/space science teachers to:

- Understand and develop the major concepts and principles of earth/space science, astronomy, geology, meteorology, oceanography and natural

resources.

- Develop understandings of the inter-connectedness of the sciences and relate the major concepts of biology, chemistry and physics to the teaching of earth/space science.
- Apply basic statistics and pre-calculus mathematics to investigations in earth/space science, including the analysis of data.
- Relate the study of earth/space science to contemporary, historical, technological and societal issues.
- Locate appropriate resources, design and conduct inquiry-based, open-ended investigations in earth/space science, interpret findings, communicate results, and make judgments based on evidence.

4. Preparation to Teach General Science: In addition to meeting the core program standards, preparation should enable general science teachers to:

- Understand and develop the major concepts and principles of biology, chemistry, earth/space science and physics.
- Develop understandings of the inter-connectedness of the sciences and relate these understandings to the teaching of general science.
- Apply basic statistics and pre-calculus mathematics to investigations in general science, including the analysis of data.
- Relate the study of general science to contemporary, historical, technological and societal issues.
- Locate appropriate resources, design and conduct inquiry-based, open-ended scientific investigations, interpret findings, communicate results, and make judgements based on evidence.
- Use and care for living organisms in an ethical and appropriate manner.

5. Preparation to Teach Physical Science: In

addition to meeting the core program standards preparation should enable physical science teachers to:

- Understand and develop the major concepts and principles of physics, chemistry, and earth/space science.
- Develop understandings of the interconnectedness of the sciences and relate these understandings to the teaching of physical science.
- Apply basic statistics and pre-calculus mathematics to investigations in physical science, including the analysis of data.
- Relate the study of physical science to contemporary, historical, technological and societal issues.
- Locate appropriate resources, design and conduct inquiry-based, open-ended investigations in physical science, interpret findings, communicate results, and make judgments based on evidence.

6. Preparation to Teach Physics: In addition to meeting the core program standards, preparation should enable physics teachers to:

- Understand and develop the major concepts and principles of physics, including concepts related to mechanics, electricity, magnetism, thermodynamics, waves, optics, atomic and nuclear physics, radioactivity, relativity and quantum mechanics.
- Develop understandings of the interconnectedness of the sciences and relate the major concepts of biology, chemistry and earth/space science to the teaching of physics.
- Apply basic statistics, calculus and introductory differential equations to investigations in physics.
- Relate the study of physics to contemporary, historical, technological and societal issues.
- Locate appropriate resources, design and conduct inquiry-based, open-ended

scientific investigations in physics,
interpret findings, communicate results,
and make judgments based on evidence.

*-- Adopted by the NSTA Board of Directors in July,
1992*

*The terms "interconnections" and
"interconnectedness" are used in this document to
represent any or all of the terms interdisciplinary,
integrated, coordinated and thematic science
education. No effort has been made to
operationalize definitions that distinguish among
these terms.



[contact us](#) • [site map](#) • [legal notice](#) • [site credits](#)