

# Science Teacher Preparation

### Introduction

To ensure that all students have sufficient knowledge and skills in science and engineering for success in the 21st century, the nation must attract, prepare, and retain well-educated, effective preK–12 science teachers. The National Science Teachers Association (NSTA) considers strong, performance-based science teacher education programs and science teacher licensure standards to be essential for all science teachers, including new and recent college graduates and those entering teaching from another profession. Based upon well-defined, commonly accepted professional standards, these programs will provide a foundation upon which teachers may build throughout their professional lives.

NSTA supports teacher preparation aligned with the goals and guidance provided by *A Framework for K–12 Science Education* (NRC 2012), the *Next Generation Science Standards* (NGSS Lead States), and *Science Teachers' Learning* (NRC 2015). NSTA has adopted and applied *Standards for Science Teacher Preparation* (NSTA 2012) and is committed to increasing the numbers of highly qualified science teachers by ensuring that all those entering the profession demonstrate a deep understanding of pure and applied science and have the knowledge and skills required to teach students science in age-appropriate, meaningful ways.

Many issues have a profound impact on the preparation of teachers, such as teacher shortages in specific fields of science, the under-representation of women and minorities in some science teaching fields, and high rates of attrition after teachers enter the classroom. NSTA supports the creation of incentives and innovative school structures to recruit, prepare, and retain talented science teachers and science-specific teaching support for new teachers after they have been certified. NSTA also advocates for organized, long-term research upon which to develop, assess, and maintain effective teacher preparation programs and for collaboration among many institutions and individuals to ensure the success of the following declarations.

### Declarations

#### Characteristics of Programs Preparing Teachers of Science.

To prepare teachers to teach science effectively, NSTA strongly recommends that all science teacher preparation programs have a curriculum that includes substantive experiences that will enable prospective teachers to

- develop robust science knowledge and skills beyond the depth and breadth needed for teaching a curriculum based on the Next Generation Science Standards or relevant state standards at the grade levels they are preparing to teach;
- organize science instruction effectively and appropriately based on the cognitive development of students;
- construct understanding of disciplinary core ideas, crosscutting concepts, and science and engineering practices that reflect the history and nature of science, including the development of major concepts, theories, assumptions, and tenets of scientific practice;
- consider the applications of science in society, the relationship of science to engineering, and the impact of cultural and personal values on science;
- create a learning environment that encourages inquiry through the use of the science and engineering practices;
- collaborate with a community of learners, including expert science teachers, science teacher educators, and pure and applied scientists;
- engage in meaningful laboratory and simulation activities using contemporary technology tools and experience other science teaching strategies with faculty who model effective teaching practices consistent with those expected of the prospective teachers;

- understand science-specific pedagogical knowledge grounded in contemporary scholarship and school environments;
- observe diverse learners' ideas of science and prepare teaching plans to help the students develop more meaningful understanding of science;
- implement their teaching plans, assess and reflect on the learning outcomes, and adjust their teaching to enhance their students' understanding;
- engage in data-based decision making regarding their teaching behaviors, strategies, and the selection of topics, activities, and materials;
- understand how to find and use credible information on the school community, on the curriculum, and on safe and effective use of laboratory activities, independent science projects, science fairs, field trips, simulations, computer tools, and alternative curriculum resources; and
- develop dispositions for effective science teaching, including a sense of responsibility to students and the community and dedication to the need to grow continually, in part through active involvement in the larger science education community.

To promote the development of needed skills, knowledge, and attitudes, NSTA recommends that science teacher preparation programs have

- a research-based focus on developing professional knowledge and skills in science and science teaching with a curriculum and management that reflects the importance of science teaching as an essential profession with its own specialized needs and functions;
- a structure for collaboration among education, science, engineering, and mathematics departments on the science teacher education course of study to ensure that prospective teachers have a solid foundation in the relevant science knowledge and skills each will teach;
- participating faculty mindful of goals and practices in the reform of science education at all levels;
- a structure for collaboration among those in higher education who develop and deliver the teacher preparation program and those who develop and deliver the clinical experiences in the schools and in other locations;
- sufficient laboratory, technology, curriculum, and other

resources to support the most effective teaching of science at the prospective teachers' levels of teaching specialization;

- science education faculty assigned to teach science-specific pedagogy with successful science teaching experience at the levels for which they are preparing candidates to teach and who have demonstrated advanced knowledge of science and pedagogy in their fields; and
- support systems in schools that feature substantive collaborative field experiences, dedication to goals of contemporary standards such as the NGSS, and integration with academic elements of the teacher preparation program.

### Accreditation and Recognition Standards for Programs Preparing Teachers of Science.

Program accreditation and state licensure standards for science teacher preparation should equal or exceed those articulated for recognition by NSTA in the *Standards for Science Teacher Preparation*. Standards should

- support the needs of the communities served and be informed by the research, best practices, and vision of professional science teachers, science teacher educators, and pure and applied scientists;
- incorporate the goals for science learning, the science knowledge, and the specialized knowledge of science teaching and learning identified in the Framework and the NGSS;
- license teachers only when they demonstrate conceptual and procedural understanding and proficiency in science and in science teaching appropriate for the grade levels the teacher is preparing to teach;
- ensure that the documentation of proficiency in teaching includes evidence of effective teaching that fosters student achievement;
- require development and maintenance by experts in science teaching, science teacher education, pure and applied science fields, as well as representatives of the communities served; and
- be amended periodically as the relevant knowledge in science, cognition, teaching, and the society evolve.

*Adopted by the NSTA Board of Directors, July 2004  
Revised, February 2017*

## References

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