



Northeastern

U N I V E R S I T Y

Master of Education in Middle School Science

This program is designed for middle school teachers who are seeking a second license in General Science or who wish to obtain greater knowledge of science education. The middle school concentration meets the Massachusetts DOE standards and competencies for license in middle school General Science.



Teachers can earn up to 80% of the credits needed for this Master of Education program through these courses offered by the Boston Science Partnership, the North Shore Science Partnership* and the Greater North Shore Science Partnership.

Northeastern University School of Education / Institute in Education /
360 Huntington Ave, 26 NI / Boston, MA 02115-5000
<http://www.spcs.neu.edu/pdp/programs/masterscience>

*Some restrictions apply.

Master of Ed. Middle School Science Specialization

Curriculum

Core (<i>choose two</i>)		8 q.h.
<u>EDU 6054</u>	Emerging Models in Education	4 q.h.
<u>EDU 6051</u>	Race and Ethnicity in Education	4 q.h.
<u>EDU 6055</u>	Socio-Cultural Context of Learning and Development	4 q.h.
Required Specialization		4 q.h.
<u>MTH 6527</u>	Mathematics for Middle School Science Teachers	4 q.h.
Specialization (<i>choose seven</i>)		28 q.h.
<u>CHM 6501</u>	The Particulate Nature of Matter	4 q.h.
<u>CHM 6502</u>	The Energetics of Chemical Change	4 q.h.
<u>GEO 6502</u>	The Solid Earth	4 q.h.
<u>GSE 6501</u>	From Science to Engineering: Pre-Engineering Design Experience	4 q.h.
<u>PHY 6501</u>	Forces, Energy, and Motion	4 q.h.
Biology I	Cell Biology and Genetics (A Human Approach)*	4 q.h.
Biology II	Ecology, Evolution, and Diversity of Life*	4 q.h.
Earth Sci I	Earth's Systems*	4 q.h.
Energy I	Integrating the Sciences through Energy*	4 q.h.
Physics II	Electricity and Magnetism*	4 q.h.
TOTAL		40 q.h.

*These courses may be held at UMass-Boston and can be transferred into the degree by special arrangement. Please note - no more than four courses from UMass-Boston (or another outside university) may be transferred into this degree.

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Northeastern University, College of Professional Studies

Master of Education – Middle School Science Specialization

Course Descriptions

Biology I (Cell Biology & Genetics - Human Approach)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course emphasizes science content, providing teachers with a rigorous understanding of the basic biological concepts that underlie human biology. The pedagogical approaches used provide opportunities for science inquiry, model ways of presenting concepts to students, and in general, link the scientific content to the classroom experience. The science content is aligned with the middle and high school Massachusetts Science and Technology/Engineering Curriculum Framework. The goal is to provide effective tools for teaching all students, including English language learners and students with special needs.

Biology II (Ecology, Evolution & Diversity of Life)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course explores ecology, evolution, and the diversity of life, building on current and future curriculum materials at the middle and secondary school levels, as well as State and National standards for the teaching of biology. Subject matter will include the mechanisms behind evolution, the development and functioning of plants, the flow of matter and energy through ecosystems, and concepts of population structure and dynamics. The course will expose students to the current state of knowledge in the scientific community through laboratory and field activities, outside reading, classroom presentations, and challenging class discussions. Students will participate in laboratory exercises drawn from national science standards-based middle and high school instructional materials. These exercises will provide an opportunity to review these teaching materials and methods and discuss research-based strategies for communicating with students.

Chemistry I (Particulate Nature of Matter)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This is a contextualized chemistry content graduate level course offered to give both in-service and pre-service teachers the in depth scientific background necessary to teach chemistry effectively. Content is aligned with the Massachusetts state standards and National Science Education Standards. This course offers an in depth exploration of fundamental principles of chemistry. This class will focus primarily on the particulate nature of matter, mechanisms of energy transfer, gas laws, chemical periodicity, and the use of scientific evidence to develop theories to explain nature. Students are exposed to current research within the scientific community through laboratory activities, outside reading, classroom presentations and in depth discussions. Students will also participate in laboratory exercises drawn from National science standards-based middle and high school instructional materials which will allow them to review these teaching materials and methods, as well as develop research-based strategies for communicating with students at various levels.

Chemistry II (Equilibrium & Thermodynamics)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course focuses on the nature of chemical reactions and the forces that drive them. These forces are explored by examining the flow of energy in reaction systems. Through this exploration participants learn why chemical reactions happen, under what conditions they happen, and how chemical equilibrium is achieved when energy flows stop. The time scales involved in achieving chemical equilibrium and how reaction rates are affected by changing temperature and the use of substances called catalysts are also addressed. Special emphasis will be placed on the role of chemical kinetics and equilibrium in the chemistry of life processes. Participants will engage in classroom and laboratory activities drawn from inquiry-based instructional materials.

Earth Science I (Weather & Water)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course crosses the boundaries of the science disciplines to focus on weather and the pivotal role that water and solar radiation play in the exchange of energy at the Earth's surface. Basic concepts such as the behavior of gases (Ideal Gas Law), energy flow, density changes, phase changes, heat capacities, isotopic fractionation processes, thermal convection, and thermohaline circulation, will be applied to examine short-term weather and water dynamics (pressure-driven fronts and flows) and longer-term impacts on global warming and climate change. The course has been designed to embrace the 7E learning cycle and instructional model.

Earth Science II (The Solid Earth - Earth's History & Planetary Systems)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course focuses on the characteristics that describe and the processes that govern the solid earth. Basic earth and planetary science concepts will be emphasized including the study of the properties of rocks, minerals, and soils; the dynamics of plate tectonics; surficial processes and landforms; fossils and the fossil record; and geography and the principles of mapping. The course will help middle school teachers train students in the fundamental concepts of Earth Science (as outlined in the Massachusetts State Science Frameworks) by illustrating how these learning standards can be used to address current environmental issues (natural disasters, natural resources, and urban planning) that may elicit and engage the interests of students. The course will expose students to the current state of knowledge in the scientific community through laboratory and field activities, outside reading, classroom presentations, and challenging classroom discussions. Students will participate in laboratory exercises drawn from National science standards-based middle and high school instructional materials which will allow them to review these teaching materials and methods, as well as develop research-based strategies for communicating with all students, especially English language learners and students with special needs.

Energy I (Integrating the Sciences through Energy)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course is a graduate-level science content course designed for pre-service and in-service middle school science teachers and contextualized to the standards/inquiry-based middle school curricula. It provides graduate-level content while modeling sound pedagogy. Using current and future curriculum materials, as well as State and National standards for the teaching of science at the middle school level, this course offers an in-depth exploration of fundamental principles of energy as they relate to biological, physical, chemical, and earth sciences. Special emphasis will be placed on the interdisciplinary relationships among these topics so that energy can be used to integrate across the disciplinary sciences. Students will be exposed to the current state of knowledge in the scientific community through laboratory activities, outside readings, classroom presentations, and in-depth discussions with classmates. Students will participate in hands-on, inquiry based exercises drawn from National science standards-based middle school instructional materials which will allow them to review these teaching materials and methods, as well as develop research-based strategies for communicating with students, especially English language learners and students with other special needs.

Engineering I (Pre-Engineering Design Experience)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This hands-on course, which is aligned with the Massachusetts Science and Technology/Engineering Framework, introduces teachers of 6-12 to the principles of engineering design and to the foundations of engineering on applied sciences and mathematics. The design process is outlined, input factors are examined and implementation is taking place with case studies. The importance of solid scientific foundations as well as creativity, optimization, safety, ethics, aesthetics, reliability, durability, serviceability, cost and market acceptability is stressed. The engineering design steps include the development and use of design methodologies, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, and detailed system descriptions.

The design process in this course will incorporate: information gathering, design methodology, technical analysis based on the laws of science and mathematics, and implementation of the solution.

Participants will learn: to address practical problems, to integrate previously learned skills, to use design methodologies and scientific/mathematical analysis to implement working solutions, to use project management techniques, to address intellectual property concerns, to effectively communicate ideas in both written and oral formats, to effectively work in a team, and to integrate ethical, social, safety, cost and environmental concerns in the design process.

Physics I (Forces, Energy & Motion)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

This course is contextualized to the FOSS “Force & Motion” and to the Active Physics “Sports” curriculum modules. Using hands-on inquiry experiences, many similar to those used in these curriculum modules, this course will provide participants with an in-depth understanding of the following concepts and principles: position, distance, displacement, speed, velocity and acceleration (Motion: Kinematics), forces, Newton’s Laws of Motion and their application to one- and two-dimensional motion (Motion: Dynamics), work, mechanical energy (kinetic & potential), momentum and energy conservation. In addition to providing high-level content, while modeling modern pedagogical techniques, this course aspires to immerse teachers in the process of inquiry, build teachers’ awareness of their role as facilitators in a student-centered environment and help them address effectively students’, as well as their own, common pre- and misconceptions specific to the curriculum materials. (Appropriate mathematical rigor will be used to prepare those who are interested in taking the MTEL licensure exam in physics.)

Physics II (Waves, Electricity & Magnetism)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

Waves, electricity and magnetism are major organizing principles of physics quite distinct from Newtonian mechanics. This is a contextualized content graduate level course offered to provide pre- and in-service teachers with the in-depth knowledge of waves, electricity and magnetism that is necessary for effective physics instruction in Boston Public Schools. This class will include content in waves, electromagnetism, electromagnetic radiation and optics. Each topic will be "contextualized" with the *Active Physics* curriculum that is used in BPS. In addition, there will be opportunities for laboratory investigations, historical and philosophical insights into the content as well as reflections and discussions on the best way to communicate this content to high school students given their backgrounds and the misconceptions research insights.

Mathematics I (Mathematics for Middle School Science Teachers)

3 semester hours/4 quarter hours of graduate credit – 60 classroom hours

The course covers mathematical concepts using mostly examples from science. Its goal is to refresh and enhance the mathematical skills middle school science teachers need to teach science more effectively. The course will cover the following topics: ratios and proportions, algebraic equations (linear and quadratic), systems of linear equations, functions (linear and quadratic, graphical representation and interpretation of graphs), basic statistical analysis of data (mean, range, standard deviation, curve fitting), basic geometry (area of triangles & circles, volume of solids, similar and congruent triangles) and basic trigonometry (sine, cosine, tangent and basic vector analysis into components). Furthermore, this is a required course for the completion of the Master of Education in Middle School Science at Northeastern University.

For more details go to:

<http://www.northshore.neu.edu/>