

## Endorsement Competencies for Earth and Space Science 5-12

2007 Standards for Earth and Space Science
<b>1.0 Common Core – Content:</b>
<b>1.1</b> The Earth and Space Science teacher knows and understands scientific concepts and principles that are needed to advance student learning as defined by state and national standards developed by the science education community, including major unifying themes. Content includes the big ideas of science (systems, order, and organization; evidence, models, and organization; constancy, changes and measurement; evolution and equilibrium; and form and function) and the mathematics underlying them. This includes basic principles of biology, chemistry, physics and mathematics as they relate to earth and space science.
<b>1.1.1</b> Mathematics – Applications of mathematics in earth and space science research, including: <ul style="list-style-type: none"><li>• Algebra.</li><li>• Probability and statistics</li></ul>
<b>1.1.2</b> Knowing – Science is a way of asking and answering questions about the physical universe. <ul style="list-style-type: none"><li>• Scientific Investigation</li><li>• Other ways of knowing science</li></ul>
<b>1.1.3</b> Structure of Earth Systems <ul style="list-style-type: none"><li>• The solid earth is composed of layers</li><li>• Interaction of lithosphere, hydrosphere, atmosphere, and biosphere</li><li>• Plate tectonics</li><li>• Landforms and seafloor formations are the result of constructive and destructive forces</li><li>• The rock cycle including characteristics of rocks and minerals and their chemical composition</li><li>• Soil formation</li><li>• Water cycle</li><li>• Structure, composition, and behavior of the atmosphere and its effect on weather and climate</li></ul>
<b>1.1.4</b> Earth History <ul style="list-style-type: none"><li>• Geological processes we see today are similar to those that occurred in the past.</li><li>• Fossils provide important evidence for how life and environmental conditions have changed.</li></ul>
<b>1.1.5</b> Earth in the Solar System <ul style="list-style-type: none"><li>• Structure of the solar system</li><li>• Motions of objects in the solar system</li><li>• Interactions and relationships of objects in the solar system</li><li>• Gravity</li><li>• The sun is the major source of energy for phenomena on the earth</li><li>• Electromagnetic radiation, solar storms, and solar wind</li></ul>
<b>1.1.6</b> Energy and Earth Systems

<ul style="list-style-type: none"> <li>• Internal and External Sources of Energy</li> <li>• Outward transfer of energy</li> <li>• External Energy drives ocean and atmospheric processes</li> <li>• Global climate is driven by energy transfer</li> </ul>
<p><b>1.1.7 Geochemical Cycles</b></p> <ul style="list-style-type: none"> <li>• Earth is a system containing a fixed amount of matter.</li> <li>• Each element on earth moves among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of geochemical cycles.</li> <li>• Movement of matter between reservoirs is driven by the earth's internal and external sources of energy.</li> </ul>
<p><b>1.1.8 Origin and Evolution of Earth Systems</b></p> <ul style="list-style-type: none"> <li>• Origin of the solar system.</li> <li>• Geologic time can be estimated using fossils, rock sequence, radioactive decay</li> <li>• Interactions among the solid earth, the oceans, the atmosphere, and organisms resulted in the ongoing evolution of the earth system.</li> <li>• The evolution of life caused dramatic changes in the composition of the earth's atmosphere.</li> </ul>
<p><b>1.1.9 Origin and Evolution of Universe</b></p> <ul style="list-style-type: none"> <li>• Origin of the universe.</li> <li>• Formation of galaxies and other celestial bodies (planets, meteors, comets) and the life cycle of stars.</li> <li>• Stars produce energy from nuclear reactions leading to the formation of elements</li> <li>• Fission and fusion reactions.</li> </ul>
<p><b>1.1.10 Supporting Knowledge: Chemistry</b></p> <ul style="list-style-type: none"> <li>• Energy, Forms, Transfer and Transformation</li> <li>• Radioisotopes</li> <li>• Properties and states of Matter</li> <li>• Bonding</li> <li>• Crystal Structure</li> <li>• Density</li> <li>• Properties of Water</li> <li>• Atomic Structure</li> </ul>
<p><b>1.1.11 Supporting Knowledge: Biology</b></p> <ul style="list-style-type: none"> <li>• Environment</li> <li>• Fossils</li> <li>• Biological Evolution</li> <li>• Biodiversity</li> <li>• Genetics</li> <li>• Organisms, including humans, effect earth systems</li> </ul>
<p><b>1.1.12 Supporting Knowledge: Physics</b></p> <ul style="list-style-type: none"> <li>• Electricity and Magnetism</li> <li>• Wave Properties</li> <li>• Gravity</li> </ul>
<p><b>1.2 Inquiry – The earth science teacher knows and understands scientific inquiry:</b></p>

- Understand how to generate and evaluate questions that can be answered through scientific investigations.
- Understand how to plan and conduct systematic and complex scientific investigations..
- Synthesize a revised scientific explanation using evidence, data, and inferential logic.
- Analyze how physical, conceptual, and mathematical models represent and are used to investigate objects, events, systems, and processes.
- Apply understanding of how to report complex scientific investigations and explanations of objects, events, systems, and processes, and how to evaluate scientific reports.
- Analyze why curiosity, honesty, cooperation, openness, and skepticism are important to scientific explanations and investigations.
- Analyze scientific theories for logic, consistency, historical and current evidence, limitations, and capacity to be investigated and modified.
- Evaluate inconsistent or unexpected results from scientific investigations using scientific explanations.
- Analyze scientific investigations for validity of method and reliability of results.
- Understand how scientific knowledge evolves.

**1.3 Nature and Context of Science** - The earth science teacher knows the values, beliefs, and assumptions inherent to the creation of scientific knowledge within the scientific community, and contrasts science to other ways of knowing.

- Analyze local, regional, national, or global problems or challenges in which scientific design can be or has been used to design a solution.
- Evaluate the scientific design process used to develop and implement solutions to problems or challenges.
- Evaluate consequences, constraints, and applications of solutions to a problem or challenge.
- Analyze how scientific knowledge and technological advances discovered and developed by individuals and communities in all cultures of the world contribute to changes in societies.
- Analyze how the scientific enterprise and technological advances influence and are influenced by human activity
- Analyze the scientific, mathematical, and technological knowledge, training, and experience needed for occupational/career areas of interest.
- Analyze the effects human activities have on Earth's capacity to sustain biological diversity.

**2.0 Common Core – Instructional Methodology:**

**2.1 Skills of Teaching:** Earth and space science teachers know the equipment, materials, and preparation required in the laboratory, including:

- Design of controlled investigations
- Data analysis and presentation
- Preparation of laboratory reports
- Operation of equipment
- Preparation of materials

<ul style="list-style-type: none"> <li>• Lab safety (including storage and disposal of hazardous waste)</li> </ul>
<p><b>2.1.1</b> Earth and space science teachers, incorporating instructional materials, create a community of diverse student learners who can construct meaning from science and possess a disposition for further inquiry and learning. Skills of Teaching refers to:</p> <ul style="list-style-type: none"> <li>• Able to use science teaching actions, strategies, and methodologies.</li> <li>• Able to establish interactions with students, including questioning techniques, that promote learning and achievement.</li> <li>• Able to effectively organize classroom, laboratory, and field experiences in different student groupings.</li> <li>• Able to use advanced technology to extend and enhance learning.</li> <li>• Able to use prior conceptions and student interests to promote new learning.</li> <li>• Able to design experiments for earth and space science.</li> <li>• Able to analyze and present data in earth and space science.</li> <li>• Able to prepare laboratory reports in earth and space science.</li> <li>• Able to operate earth and space science laboratory equipment.</li> <li>• Able to prepare materials used in the earth and space science laboratory.</li> <li>• Able to establish and enforce lab safety (including storage and disposal of hazardous waste) in the earth and space science laboratory.</li> <li>• Monitor students' understanding of content through a variety of assessment strategies, provide feedback to students to assist learning, adjust instruction and encourage students to learn to work together to solve problems.</li> <li>• Being able to use advanced technology to extend and enhance learning.</li> <li>• Design, conduct, and evaluate laboratory activities that target the development of science concepts, using techniques, equipment, and facilities that meet current technological standards including computer applications to science teaching and hands-on laboratory experiences, equipment, and laboratory notebook.</li> <li>• Being able to use prior conceptions and student interests to promote new learning.</li> <li>• Integrate reading, writing, communication, mathematics, social studies, and health/fitness into the teaching of earth and space science.</li> </ul>
<p><b>2.2</b> Curriculum – Earth and space science teachers know the earth and space science curriculum.</p> <ul style="list-style-type: none"> <li>• Understand the application of student learning goals including the EARLs and GLEs to design lessons that target state standards (i.e., read with comprehension, write with skill, and communicate effectively with responsibility in a variety of ways and settings, know and apply the core concepts).</li> </ul>
<p><b>2.2.1</b> The earth and space science teacher develops and applies a coherent, focused earth and space curriculum that is consistent with state and national standards for earth and space science education and appropriate for addressing the need, abilities, and interests of students. Curriculum refers to:</p> <ul style="list-style-type: none"> <li>• Able to develop and apply an extended framework of goals, plans, materials, and resources for instruction.</li> <li>• Able to develop and apply science principles, both in and out of school.</li> <li>• Able to plan instruction which promotes problem analysis, critical thinking, creativity, leadership development and decision-making based upon subject matter, organization and integration of content and the relationship of content to</li> </ul>

<p>education, career and life goals; student learning and motivation, with emphasis on individual differences and diversity; the community and community resources; and current education standards and practices.</p> <ul style="list-style-type: none"> <li>• Select, analyze, modify and incorporate instructional materials to meet the learning needs and reading level of diverse learners including curriculum resources and technology; inquiry based laboratory experiences; and information from the internet, professional organizations, and business and industry.</li> </ul>
<p><b>2.3 Social Context</b> – Earth and space science teachers know the relation between science and the community and know the human and institutional resources in the community. The social context of science teaching refers to:</p> <ul style="list-style-type: none"> <li>• Knowing examples of social and community support networks within which occur life science teaching and learning.</li> <li>• Knowing the relationship of science teaching and learning to the needs and values of various communities.</li> </ul>
<p><b>2.3.1</b> Earth and space science teachers can relate science to the community and use human and institutional resources in the community to advance the education of their students in earth and space science. The social context of science teaching refers to:</p> <ul style="list-style-type: none"> <li>• Being able to develop the social and community support network within which science teaching and learning occur.</li> <li>• Being able to relate science teaching and learning to the needs and values of the community.</li> <li>• Being able to involve people and institutions from the community in the teaching of science.</li> </ul>
<p><b>2.4 Assessment</b> - The earth and space science teacher knows a variety of contemporary assessment strategies to evaluate the intellectual, social, and personal development of the learner in all aspects of earth and space science. Assessment refers to:</p> <ul style="list-style-type: none"> <li>• Knowing the measurement and evaluation of student learning in a variety of dimensions including state assessments.</li> </ul>
<p><b>2.4.1</b> The earth and space science teacher uses a variety of contemporary assessment strategies to evaluate the intellectual, social, and personal development of the learner in all aspects of science. Assessment refers to:</p> <ul style="list-style-type: none"> <li>• Identifying outcomes to be measured.</li> <li>• Being able to align learning targets, instructions, and outcomes.</li> <li>• Being able to measure and evaluate student learning in a variety of dimensions.</li> <li>• Being able to use outcome data to guide and change instruction.</li> <li>• Monitoring and assessing students’ understanding of content through a variety of means, providing feedback to students to assist learning and adjusting instructional strategies.</li> </ul>
<p><b>2.5 Environment for Learning</b> – Earth and space science teachers know safe and supportive learning environments reflecting high expectations for the success of all students. Learning environments refers to:</p> <ul style="list-style-type: none"> <li>• Know examples of changes that can make physical spaces more effective for learning science.</li> <li>• Know typical examples of psychological and social environments of the student engaged in learning science.</li> </ul>

<ul style="list-style-type: none"> <li>• Know safety in all areas related to science instruction.</li> </ul>
<p><b>2.5.1</b> Earth and space science teachers design and manage the instructional environment:</p> <ul style="list-style-type: none"> <li>• Able to design/manage physical spaces to enhance learning of science.</li> <li>• Able to create a climate that promotes fairness.</li> <li>• Able to establish and maintain rapport with students.</li> <li>• Able to communicate clear, challenging expectations to each student</li> <li>• Able to establish and maintain consistent standards of classroom behavior.</li> <li>• Able to use instructional time effectively.</li> <li>• Able to demonstrate safe treatment and ethical use of living organisms.</li> <li>• Able to create a safe environment conducive to learning.</li> </ul>
<p><b>3.0 Common Core – Professional Practice:</b></p>
<p><b>3.1</b> Earth and space science teachers have a knowledge base that prepares them for professional practice. Professional practice refers to:</p> <ul style="list-style-type: none"> <li>• Knowledge of science and educational professional organizations.</li> <li>• Knowledge of standards of ethical behavior consistent with the best interests of students and the community.</li> </ul>
<p><b>3.2</b> Earth and space science teachers participate in the professional community, improving practice through their personal actions, education, and development. Professional practice refers to teachers being able to:</p> <ul style="list-style-type: none"> <li>• Participate in the activities of the professional community to include colleagues, organizations, and other agencies, to improve student learning.</li> <li>• Demonstrate ethical behavior consistent with the best interests of students and the community, as stated in Washington’s Code of Professional Conduct, and local, state, and federal laws and regulations.</li> <li>• Reflect on professional practices and continuous efforts to ensure the highest quality of science instruction.</li> <li>• Willingly work with students and new colleagues as they enter the profession.</li> <li>• Communicate effectively with parents/guardians, business and industry, and other agencies, and the community at large to support learning by all students.</li> </ul>