

Iowa Core – Davenport Schools
Priority Essential Concepts and Skills for Kindergarten Science

We believe that the scientifically literate person is one who is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes.

Science for All Americans, 1990

Introduction

The need for scientific literacy in today's increasingly technological world, for fundamental reforms in how science is taught, and for well-validated models that districts might emulate are by now well-known and documented. Expressions of concern from business leaders, scientists, and educators have led to national, state, and local initiatives. The Iowa Core Curriculum rose from those concerns. It has been a two-decade process in which the Department of Education initiated conversations and produced a body of work that laid the groundwork for this effort. Each of those early efforts led us closer to the design that would produce the clearest picture and become the most useful. This committee used both national and state level documents in this process. The final standards are drawn from the respected work of the National Research Council's (NRC) National Science Education Standards (NSES). The Iowa Core Curriculum is a common set of expectations designed to clarify and raise expectations for all students. It is a tool for Iowa educators to use to assure that essential subject matter is being taught and essential knowledge and skills are being learned.

As the amount of scientific knowledge expands, the need for ALL students to have a deep understanding of essential concepts increases. Technological advances have made information more readily available and decreased the need to memorize vocabulary and formulas. The scientific community agrees that we should teach fewer concepts at greater depth. The Iowa Core Curriculum of essential concepts and abilities in Science is a rich, yet manageable, set that will give each district a comprehensive model to evaluate local curricula. It moves beyond, as stated in the research report, Taking Science to School (National Research Council, The National Academies. Washington, D.C. 2007) "a focus on the dichotomy between either content knowledge or process skills because content and process are inextricably linked in science. Students who are proficient in science:

1. Know, use, and interpret scientific explanations of the natural world;
2. Generate and evaluate scientific evidence and explanations;
3. Understand the nature and development of scientific knowledge; and
4. Participate productively in scientific practices and discourse.

These strands of proficiency represent learning goals for students as well as a broad framework for curriculum design. They address the knowledge and reasoning skills that students must acquire to be proficient in science and, ultimately, able to participate in society as educated citizens."

The Iowa Core Curriculum for Science reflects the belief that ALL students should experience science through a curriculum that is rigorous, relevant, global in its perspective, collaborative in nature, and connected by strong visible links to other areas of study. This document follows the format and content of NSES in which there are eight categories of standards. Four of the categories — Science as Inquiry, Physical Science, Earth and Space Science, and Life Science — are content specific, while the remaining categories — Science and Technology, Science in Personal and Social Perspectives, and the History and Nature of Science — address the application of knowledge. These remaining standards sets call for students to develop abilities to identify and state a problem, design, implement and evaluate a solution, and they complement the abilities developed in the Science as Inquiry Standards. They also help students develop decision-making skills and understand that science reflects its history and is an ongoing, changing enterprise. As such, these standards should be integrated throughout the four content specific categories stated above. These sets include the following at the 9 – 12 level: Science and Technology — abilities of technological design, and understanding about science and technology; Science in Personal and Social Perspectives — personal and community health, population growth, natural resources, environmental quality, natural and human-induced hazards, and science and technology in local, national, and global changes; History and Nature of Science — science as a human endeavor, nature of scientific knowledge, and historical perspectives (see appendix). Science as Inquiry and the

application standards from the NSES are integrated into the knowledge base by design. The content category of Unifying Concepts and Processes complements the other standards. The concepts and procedures in this category provide students with productive and insightful ways of thinking about and integrating basic ideas that explain the natural and designed world (see appendix for details). These concepts and processes include:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

Science is more than a body of knowledge. It is a way of thinking and a way of investigating. Students must have the opportunity to examine the impact science has had, and will continue to have, on the environment and society. These opportunities are the focus of the integrated standards.

The Iowa Core Curriculum for Science emphasizes student inquiry. The depth of understanding required of our students is not possible with lectures, readings, cookbook labs, and plug-and-chug problem solving. Students must be actively investigating: designing experiments, observing, questioning, exploring, making and testing hypotheses, making and comparing predictions, evaluating data, and communicating and defending conclusions. A district's science curriculum cannot align to the Iowa Core Curriculum for Science without including inquiry as a guaranteed and viable, testable component in every science course. The science

instruction should be engaging and relevant for the students. Strong connections between the lessons and the students' daily lives must be made. This core curriculum reflects high standards of science achievement for ALL students and not just those who have traditionally succeeded in science classes.

The challenge is to create an educational system that connects students to the scientific world. The broad range of understandings and skills possessed by students when they enter 9th grade will require a system that is clearly articulated and masterfully implemented from kindergarten through grade 12. Teachers will need support and time to prepare for this challenge. This is a first bold step toward a vision of scientific literacy for all.

Science as Inquiry

Essential Concept and/or Skill: *Ask questions about objects, organisms, and events in the environment.*

Students should answer their questions by seeking information from their own observations, investigations and from reliable sources of scientific information.

Essential Concept and/or Skill: *Plan and conduct simple investigations.*

In earliest years, investigations are largely based on direct observations. As students develop, they design and conduct simple investigations to answer questions.

It is important to follow appropriate safety procedures when conducting investigations.

Essential Concept and/or Skill: *Use tools to gather data and extend the senses.*

Students use tools such as rulers, thermometers, watches, balances, spring scales, magnifiers and microscopes to extend their senses and their abilities to gather data.

Essential Concept and/or Skill: *Use mathematics in scientific inquiry.*

Mathematics is used to gather, organize and present data and to construct convincing explanations.

Essential Concept and/or Skill: *Use data to construct reasonable explanations.*

Students should learn what constitutes evidence. Students' explanations should reflect the evidence they have obtained.

Essential Concept and/or Skill: *Communicate investigations and explanations.*

Students should begin to develop the abilities to communicate, critique, and analyze their work and the work of other students. Students should communicate orally, through writing or through drawings.

Essential Concept and/or Skill: *Follow appropriate safety procedures when conducting investigations.*

Earth and Space

Essential Concept and/or Skill: *Understand and apply knowledge of observable information about daily and seasonal weather conditions.*

Example:

- Weather changes from day to day and over the seasons.

Essential Concept and/or Skill: *Understand and apply knowledge of events that have repeating patterns.*

Examples:

- Seasons of the year, day and night are events that are repeated in regular patterns.
- The sun's position in the sky can be observed and described.
- The sun can only be seen during our daylight hours. We are unable to see the sun at night because of the rotation of the earth.

Physical Science

Essential Concept and/or Skill: *Understand and apply knowledge of observable and measurable properties of objects.*

Examples:

- Objects have many observable properties including size, weight, shape, color, temperature and the ability to react with other substances.
- Those properties can be measured using tools such as rulers, balances and thermometers.
- Objects are made of one or more materials.
- Objects can be described by the properties of the materials from which they are made. Properties can be used to separate or sort a group of objects or materials.

Essential Concept and/or Skill: *Understand and apply knowledge of characteristics of liquids and solids.*

Examples:

- Materials can exist in different states – solid, liquid, and gas.
- Some common materials, such as water, can be changed from one state to another by heating or cooling.

Life Science

Essential Concept and/or Skill: *Understand and apply knowledge of the characteristics of living things and how living things are both similar to and different from each other and from non-living things.*

Examples:

- Living things share some common characteristics that are both similar to and different from non-living things.
- Different species of plants and animals have different observable characteristics by which they can be classified.

Essential Concept and/or Skill: *Understand and apply knowledge of life cycles of plants and animals.*

Example:

- Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying.

Essential Concept and/or Skill: *Understand and apply knowledge of basic human body structures (human body parts and their functions).*

Example:

- Humans have distinct body structures for functions including but not limited to thinking, walking, holding, seeing and talking.

Essential Concept and/or Skill: *Understand and apply knowledge of good health habits.*