

## Conceptual Shifts in the *Alabama Course of Study: Science*

### Group 1

**Shift 1: The standards in the *2015 Alabama Course of Study: Science* reflect how science is done in the real world by intertwining three dimensions: scientific and engineering practices, crosscutting concepts, and disciplinary core ideas.**

Scientists ask and answer questions to further our understanding of the world around us. Engineers define problems and design solutions to solve problems. The intent of the course of study is to weave the three dimensions together, as recommended by *A Framework for K-12 Science Education*, to reflect the work of scientists and engineers. For example, students are expected to use scientific and engineering practices and apply crosscutting concepts to develop an understanding of disciplinary core ideas. This is a conceptual shift from previous standards, which separate these dimensions into curriculum, instruction, and assessment. Curriculum often initially focuses on the science process skills of inquiry without emphasizing science content. To prepare students for the competitive global economy, we must equip them with the skills and information to develop a sense of contextual understanding of scientific knowledge: how scientists acquire it, how engineers apply it, and how it is connected through crosscutting concepts. These understandings can be achieved by interlocking the three dimensions. Therefore, each course of study standard integrates scientific and engineering practices to understand disciplinary core ideas and connect ideas across disciplines by applying crosscutting concepts.

**Shift 5: The standards in the *2015 Alabama Course of Study: Science* integrate science, technology, and engineering throughout grades K-12.**

The standards in the course of study integrate applications of science, technology, and engineering into the disciplinary core ideas along with life, Earth, space, and physical science. This conceptual shift also raises engineering design to the same level as scientific inquiry. This requires the development of curriculum, instruction, and assessments – as well as teacher preparation – to integrate engineering and technology into the structure of science education. Science and engineering are needed to address challenges we face in our ever-changing world, such as an adequate food supply, clean water, renewable energy, and disease control. Hopefully, students will be motivated to pursue careers rooted in science, technology, engineering, and mathematics as a result of early opportunities to apply their scientific knowledge to develop solutions to similar challenges. Integrating science, technology, and engineering into curriculum and instruction empowers students to apply what they learn to their everyday lives beginning in kindergarten, throughout their academic careers, and beyond.

How will these shifts benefit student learning in classrooms across your school or district?

## Conceptual Shifts in the *Alabama Course of Study: Science*

### Group 2

#### **Shift 3: The standards in the *2015 Alabama Course of Study: Science* build coherently from grades K-12.**

The standards in the course of study concentrate on a limited number of essential disciplinary core ideas that build student understanding through a series of learning progressions from grades K through 12. The learning progressions are anchored at one end by the concepts and reasoning abilities that young children bring with them to school and at the other end by what graduates are expected to know about science. The conceptual shift is the movement away from learning disjointed and isolated facts and toward opportunities to learn more complex ideas as students progress through grade levels and bands. The disciplinary core ideas identified in the course of study form a coherent progression of knowledge leading to more complexity of student understanding by the end of high school. The goal is to help students achieve scientific and engineering literacy by focusing on fundamental content that builds as they progress. The standards progressions are based on the assumption that students have learned previous content and can build on their understandings. Therefore, it is critical that students master the content designated for each grade level or band. The omission of any content in a grade level or band can negatively impact student understanding of increasingly more complex core ideas as students advance through grades K-12.

#### **Shift 4: The standards in the *2015 Alabama Course of Study: Science* focus on deeper understanding of content and applications of content.**

The standards in the course of study focus on disciplinary core ideas rather than the myriad of facts associated with each core idea. Although the facts support the core ideas, they should not be the focus of curriculum, instruction, and assessment. The conceptual shift places more emphasis on the core ideas and less on facts to provide an organizational structure that delivers the scaffolding students need when acquiring new knowledge. Research indicates experts understand core principles and theoretical constructs of their field and use them to make sense of new information or to apply their understandings to solve problems. Novices hold disconnected and even contradictory pieces of knowledge as isolated facts and have difficulty organizing and integrating the pieces. Therefore, the intent of the standards is to engage students in scientific and engineering practices to gain a deeper understanding of the disciplinary core ideas and connect those ideas with crosscutting concepts to help them develop from novices into experts.

How will these shifts benefit student learning in your school or district?

## Conceptual Shifts in the *Alabama Course of Study: Science*

### Group 3

**Shift 2: The standards in the *2015 Alabama Course of Study: Science* are student performance expectations.**

“Performance expectations describe what students should be assessed on at the end of instruction but do not describe how to support students in realizing them.” (Joe Krajcik) Student performance expectations clarify what students should know and be able to do at the end of a grade level or band. This conceptual shift recognizes the standards are *not* curriculum, instruction, or assessment; the standards *are* student performance expectations that elucidate the intent of assessments. The three dimensions are integrated in each performance expectation and are intended to enhance instruction and curriculum, not limit it. The scientific and engineering practices and crosscutting concepts should be used throughout the curriculum and instruction so students have many opportunities to become proficient at using the practices to deepen their understanding of disciplinary core concepts by connecting them with crosscutting concepts. Backward curriculum design will be required to analyze each performance expectation and develop an instructional sequence that will help students achieve the outcomes in the standards.

**Shift 6: The standards in the *2015 Alabama Course of Study: Science* are designed to prepare students for college, careers, and citizenship.**

There is no doubt that science and science education are central to the lives of all Americans. Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one’s health care, understanding science is the key. Science is also at the heart of the ability of the United States to continue to innovate, lead, and create the jobs of the future. All students, no matter what their future education and career path, must have a solid K-12 science education in order to be prepared for college, careers, and citizenship.

**Shift 7: The standards in the *2015 Alabama Course of Study: Science* correlate to the CCRS standards in ELA and math.**

The standards are the vehicle for mastering the standards in ELA and math. Science and engineering provide a content area for applying ELA and mathematics skills. The conceptual shift is away from viewing ELA and math as content areas to the perception that they are skills to be practiced and mastered in the science and engineering curriculum. A synergy is created when ELA, math, science, and engineering standards reinforce the acquisition of the skills and knowledge in all of these areas of the school curriculum.

How will these shifts impact instructional planning in your school or district?