Shelby County Schools Science Vision

Shelby County Schools' vision of science education is to ensure that from early childhood to the end of the 12th grade, all students have heightened curiosity and an increased wonder of science; possess sufficient knowledge of science and engineering to engage in discussions; are able to learn and apply scientific and technological information in their everyday lives; and have the skills such as critical thinking, problem solving, and communication to enter careers of their choice, while having access to connections to science, engineering, and technology.

To achieve this, Shelby County Schools has employed The Tennessee Academic Standards for Science to craft meaningful curricula that is innovative and provide a myriad of learning opportunities that extend beyond mastery of basic scientific principles.

Introduction

In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality standards aligned instruction. The Tennessee Academic Standards for Science provide a common set of expectations for what students will know and be able to do at the end of each grade, can be located in the Tennessee Science Standards Reference. Tennessee Academic Standards for Science are rooted in the knowledge and skills that students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curricula provide instructional planning designed to help students reach these outcomes. The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness. Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators of their own learning through problem solving and thinking critically. The Science and Engineering Practices are valuable tools used by students to engage in understanding how scientific knowledge develops. These practices rest on important "processes and proficiencies" with longstanding importance in science education. The science maps contain components to ensure that instruction focuses students toward understanding how science and engineering can contribute to meeting many of the major challenges that confront society today. The maps are centered around five basic components: the Tennessee Academic Standards for Science, Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Phenomena.

The Tennessee Academic Standards for Science were developed using the National Research Council's 2012 publication, A Framework for K-12 Science Education as their foundation. The framework presents a new model for science instruction that is a stark contrast to what has come to be the norm in science classrooms. Thinking about science had become memorizing concepts and solving mathematical formulae. Practicing science had become prescribed lab situations with predetermined outcomes. The framework proposes a three-dimensional approach to science education that capitalizes on a child's natural curiosity. The Science Framework for K-12 Science Education provides the blueprint for developing the effective science practices. The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices. The importance of combining Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas is stated in the *Framework* as follows:

Standards and performance expectations that are aligned to the framework must take into account that students cannot fully understand scientific and engineering ideas without engaging in the practices of inquiry and the discourses by which such ideas are developed and refined. At the same time, they cannot learn or show competence in practices except in the context of specific content. (NRC Framework, 2012, p. 218)

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term "practices" instead of a term such as "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practices over each grade band. Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. There are seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world.

The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice. In fact, our goal is not to merely "cover the curriculum," but rather to "uncover" it by developing students' deep understanding of the content and mastery of the standards. Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices. However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable. We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

Science and Engineering Practices

1. Asking questions & defining problems
2. Developing & using models
3. Planning & carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics & computational thinking
6. Constructing explanations & designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, & communicating information

Disciplinary Core Ideas

Physical Science
PS 1: Matter & its interactions
PS 2: Motion & stability: Forces & interactions
PS 3: Energy
PS 4: Waves & their applications in technologies for information transfer

Life Sciences
LS 1: From molecules to organisms: structures & processes
LS 2: Ecosystems: Interactions, energy, & dynamics
LS 3: Heredity: Inheritance & variation of traits
LS 4: Biological evaluation: Unity & diversity

Earth & Space Sciences
ESS 1: Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth & human activity

Engineering, Technology, & the Application of Science
ETS 1: Engineering design
ETS 2: Links among engineering, technology, science, & society

Crosscutting Concepts

1. Patterns
2. Cause & effect
3. Scale, proportion, & quantity
4. Systems & system models
5. Energy & matter
6. Structure & function
7. Stability & change

Learning Progression

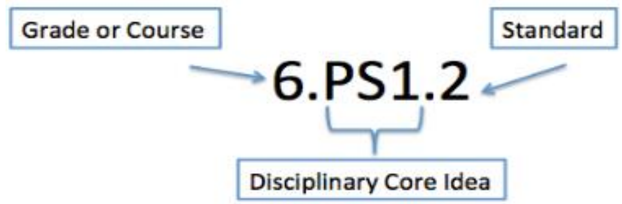
At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

Structure of the Standards

- Grade Level/Course Overview: An overview that describes that specific content and themes for each grade level or high school course.
- Disciplinary Core Idea: Scientific and foundational ideas that permeate all grades and connect common themes that bridge scientific disciplines.
- Standard: Statements of what students can do to demonstrate knowledge of the conceptual understanding. Each performance indicator includes a specific science and engineering practice paired with the content knowledge and skills that students should demonstrate to meet the grade level or high school course standards.



Purpose of Science Curriculum Maps

This map is a guide to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025. It is a resource for organizing instruction around the Tennessee Academic Standards for Science, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content (scope) and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

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4th Grade Quarter 4 Curriculum Map

[Quarter 4 Curriculum Map Feedback]

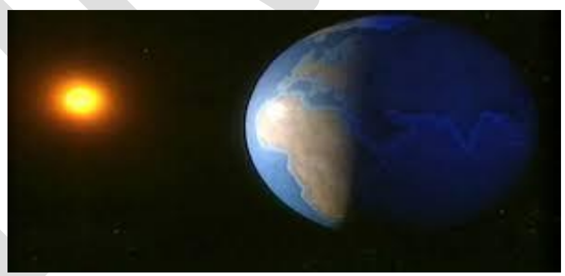
Quarter 1		Quarter 2		Quarter 3		**Quarter 4**
Structure and Routine	Unit 1 Interactions of Living Things	Unit 2 Energy	Unit 3 Wave Patterns and Information Transfer	Unit 4 Earth and Its Resources	Unit 5 Earth and Its Changing Features	**Unit 6 The Sun and Earth**
1 week	8 weeks	4 weeks	5 weeks	3 weeks	6 weeks	**9 weeks**

UNIT 6: The Sun and Earth (9 weeks)

Overarching Question(s)

What is the universe, and what is Earth's place in it?

Unit 6: Lesson 1	Lesson Length	Essential Question	Vocabulary
Day and Night	4.5 weeks	What causes the day and night cycle on Earth?	axis, revolution, rotation

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 4.ESS1: Earth's Place in the Universe **Standard(s)** 4.ESS1.2: Use a model to explain how the orbit of the Earth and sun cause observable patterns: a day and night; b. changes in length and direction of shadows of a day. **Explanation and Support of Standard** 4.ESS1.2 Student models should be used to explain patterns that have been observed in earlier standards. Components in student models should include the sun, Earth, and objects creating shadows. This	**Learning Outcomes** Students will demonstrate how the rotation of Earth causes the day and night cycle. **Suggested Phenomena** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 159-160 TE, p. 159: Phenomenon Be a Scientist Notebook (Phenomenon): p.159 TE, Essential Question: p. 160 TE, Science and Engineering Practices: p. 160 Explore TE, pp. 160-161 *(LAB)* Be a Scientist Notebook, p. 167, Inquiry Activity: Day and Night Explain TE, pp. 162-166

standard is limited to patterns that occur on a daily basis, as opposed to patterns such a seasons that occur over larger spans of time. Opportunities to explore this standard might include recording the length of their shadows at preset times during the day, using a spotlight/floodlight/flashlight to model this process within a classroom, and/or creating a model using spheres and a flashlight. (Students have recorded observations for many of these patterns in 1.ESS1.3.) **Suggested Science and Engineering Practice(s)** Developing and Using Models **Suggested Crosscutting Concept(s)** Patterns **Teacher Overview** Earth makes one revolution in its orbit around the Sun during a year. Revolution is different from rotation. Day and night is a result of the rotation of Earth on its axis. It takes about 24 hours for Earth to complete one rotation. As Earth rotates, part of its surface faces the Sun and experiences daytime. The part facing away from the Sun experiences nighttime. **Misconceptions** Students may believe that the words revolution and rotation have the same meaning. Explain that when Earth revolves around the Sun, it travels in an ellipse	Phenomenon Explanation: Earth spins around one time in one day. It is daytime when our side of Earth is toward the Sun. Scientists point to the annual repetition of constellations as evidence that supports a yearly orbit around the Sun. Historically (until the 16th century), the prevailing view was that the Sun revolved around Earth.	Be A Scientist Notebook, p. 169: Vocabulary Video: Earth and the Sun Science Handbook/eBook: Earth in Space Elaborate TE, pp. 166-167 *(LAB)* Be a Scientist Notebook, p. 173, Inquiry Activity: The Day and Night Cycle Evaluate TE, pp. 167-169 *(LAB)* Be A Scientist Notebook, p. 175, Performance Task: Model of the Sun and Earth eAssessment **Additional Resources** Lesson: What Makes Night and Day? Lesson: 4th Grade Lesson Day and Night Video: Day and Night Cycle **ESL Supports and Scaffolds** WIDA Standard 4 To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates MES English Flashcards Get Epic

(a shape similar to a circle). At the same time Earth is revolving, it is rotating (spinning) on its axis. You may want to demonstrate these meanings to students by walking around the classroom in an elliptical pattern to show revolution and by turning around slowly to show rotation.		Day and Night Day and Night v2

4th Grade Quarter 4 Curriculum Map Quarter 4 Curriculum Map Feedback							
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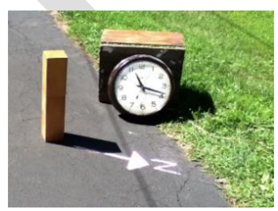
Structure and Routine	Unit 1 Interactions of Living Things	Unit 2 Energy	Unit 3 Wave Patterns and Information Transfer	Unit 4 Earth and Its Resources	Unit 5 Earth and Its Changing Features	**Unit 6 The Sun and Earth**	
	8 weeks	4 weeks	5 weeks	3 weeks	6 weeks	**9 weeks**	

UNIT 6: The Sun and Earth (9 weeks)			
Overarching Question(s)			
What is the universe, and what is Earth's place in it?			
Unit 6: Lesson 2	**Lesson Length**	**Essential Question**	**Vocabulary**
Shadows	4.5 weeks	Why does the Sun cause different shadows during the day?	apparent motion, shadow

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 4.ESS1 Earth's Place in the Universe **Standard(s)** 4.ESS1.2: Use a model to explain how the orbit of the Earth and sun cause observable patterns: a day and night; b. changes in length and direction of shadows of a day. **Explanation and Support of Standard** 4.ESS1.2 Student models should be used to explain patterns that have been observed in earlier standards. Components in student models should include the	**Learning Outcomes** Students will be able to demonstrate how the position of the Sun in the sky affects the shadows cast on Earth's surface. **Suggested Phenomena** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** Engage Inspire Science TE, p. 171-172 TE, p. 171: Phenomenon Be a Scientist Notebook (Phenomenon): p. 179 TE, Essential Question: p. 180 TE, Science and Engineering Practices: p. 180 Explore TE, pp. 173-174 *(LAB)* Be a Scientist Notebook, p. 181, Inquiry Activity: Shadows Explain

sun, Earth, and objects creating shadows. This standard is limited to patterns that occur on a daily basis, as opposed to patterns such a seasons that occur over larger spans of time. Opportunities to explore this standard might include recording the length of their shadows at preset times during the day, using a spotlight/floodlight/flashlight to model this process within a classroom, and/or creating a model using spheres and a flashlight. (Students have recorded observations for many of these patterns in 1.ESS1.3.) **Suggested Science and Engineering Practice(s)** Developing and Using Models **Suggested Crosscutting Concept(s)** Patterns **Teacher Overview** Studying shadows is an effective way to help students begin to understand Earth and space science. Shadows are everywhere, and they are easy to create, measure, and replicate. Ancient Greeks believed that light originated not from the Sun but from the human eye and traveled to the object that the eye saw. Some students today still hold this false belief. **Misconceptions** Students may think that shadows' length and shape change throughout the day because the Sun	Phenomenon Explanation: The size of the shadow changes during the day because the Earth spins on its axis. Although ancient cultures believed that the Sun moved across the sky, modern satellites and spacecraft allow us to see Earth's rotations.	TE, pp. 174-178 Be A Scientist Notebook, p. 183: Vocabulary Simulation: The Night Sky Science Handbook/eBook: Apparent Motion and Shadows Digital Interactive: How Shadows Change Elaborate TE, pp. 179-180 *(LAB)* Be a Scientist Notebook, p. 187, Inquiry Activity: Understanding Shadows Using a Sundial Evaluate TE, pp. 180-181 *(LAB)* Be A Scientist Notebook, p. 189, Performance Task: Shadow Models eAssessment **Additional Resources** Lesson: Shadows Video: Shadow **ESL Supports and Scaffolds** WIDA Standard 4 To support students in speaking refer to this resource: WIDA Doing and Talking Science When applicable- use Home Language do build vocabulary in concepts. Spanish Cognates

moves around Earth. Explain that shadows change during the day because Earth is rotating on its axis. Some students believe that the Sun disappears at night. Explain that Earth's rotation means that when our part of the planet is in darkness, the opposite side of Earth is in sunlight.		Sentence stems: The sun causes shadows when----- Shadows are cause by______ Shadow lessons