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.

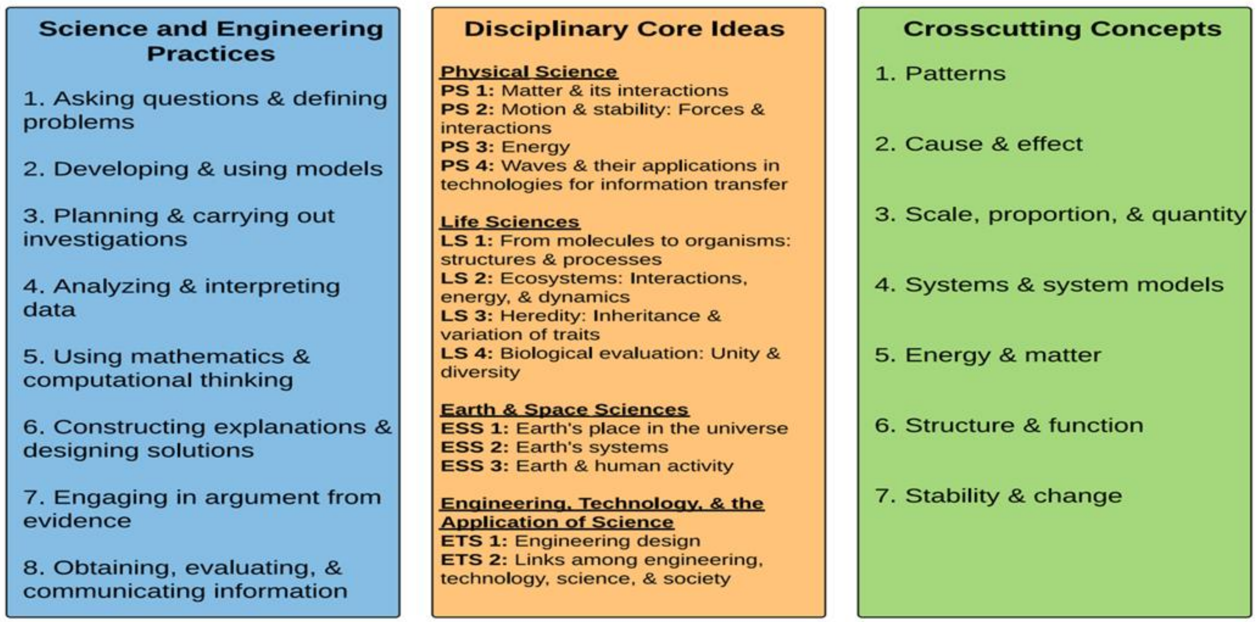
Our collective goal is to ensure our students graduate ready for college and career. Being College and Career Ready entails, many aspects of teaching and learning. We want our students to apply their scientific learning in the classroom and beyond. These valuable experiences include students being facilitators 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.



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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3rd Grade Quarter 2 Curriculum Map Quarter 2 Curriculum Map Feedback							
Quarter 1			**Quarter 2**	Quarter 3		Quarter 4	
Structure and Procedure	Unit 1 Matter	Unit 2 Magnetic Forces	**Unit 3** **Energy**	Unit 4 Solar System	Unit 5 Weather and Climate	Unit 6 Types of Living Things	Unit 7 Survival of Animals and Plants
1 week	5 weeks	3 weeks	**9 weeks**	3 weeks	6 weeks	3 weeks	3 weeks

UNIT 3: Energy (9 weeks)			
Overarching Question(s)			
How is energy transferred and conserved?			
Unit 3: Energy, Lesson 1	**Lesson Length**	**Essential Question**	**Vocabulary**
Energy Transfer and Motion	3 weeks	What makes things move?	electrical energy, energy, kinetic energy, potential energy

Standards and Related Background Information	Instructional Focus	Instructional Resources
DCI(s) 3.PS3 Energy **Standard(s)** 3.PS3.1: Recognize that energy is present when objects move; describe the effects of energy transfer from one object to another. **Explanation and Support of Standard** 3.PS3.1 A system possesses energy whenever there is motion present in that system. This energy can simply be called the energy of motion. When one object runs	**Learning Outcomes** Students will set up a situation that demonstrates potential and kinetic energy, and contrasts those to objects that do not have energy. Students will design a device that shows several ways in which energy can be transferred. **Suggested Phenomenon** *Click on the phenomenon picture to view the video.*	**Curricular Resources** Engage Inspire Science TE, p. 247-248 TE p. 247, Phenomenon Be a Scientist Notebook, p.257, Phenomenon Be a Scientist Notebook, p. 258, Essential Question Explore TE, pp. 248-249

another object, energy will transfer from one object to another and the motion of each will change. When objects collide, one of the effects is that some energy also gets transferred to the surrounding air, which heats the air, producing sound. Students observed in 1.PS3.1 that the light from the sun brings energy to Earth. This should be extended to note any collision that produces sound and light will have lost energy to the surrounding environment. Sound, light and heat are all evidence of energy transformations. *These effects are all observable in one demonstration if two cannonballs, one wrapped in aluminum foil, are banged together (If attempting, be very cautions to not smash finger tips.)* **Suggested Science and Engineering Practice(s)** Constructing Explanations and Designing Solutions **Suggested Crosscutting Concept(s)** Energy and Matter **Teacher Overview** There are many different forms of energy, including sound, light, heat, and electric current. The law of conservation of energy is a principle that states that energy cannot be created or destroyed. Instead, energy is transformed from one type to another. Heat is transferred when it moves from a warm object to a	 Phenomenon Explanation: Energy takes different forms and moves from place to place. Movement, sound, light, heat, and electrical current are evidence of energy moving from one place or form to another.	*(LAB)* Be a Scientist Notebook, p. 259, Inquiry Activity: Measuring Motion and Speed Explain TE, pp. 249-254 Be A Scientist Notebook, p. 261: Vocabulary Science Handbook/eBook: Position Science Handbook/eBook: Forms of Energy Video: Energy Transfers Digital Interactive: Energy Transfers in the Classroom *(LAB)* Be A Scientist Notebook, p.265, Inquiry Activity: Sound in Motion Elaborate TE, pp. 254-255 *(LAB)* Be a Scientist Notebook, p. 267, Inquiry Activity/Simulation: Energy Transfer Through Matter Evaluate TE, pp. 255-257 *(LAB)* Be A Scientist Notebook, p. 268 Performance Task: Electrical Scavenger Hunt eAssessment

cooler object. Heat can be transferred by radiation, conduction, and convection. Radiation is the transfer of energy as waves or particles through space or another medium. The energy in an X-ray is radiation energy. Conduction is the transfer of energy from particle to particle. Convection is the transfer of energy by mass motion of a fluid, such as air or water. Sound energy moves as a compressional wave (like a coiled toy) through a medium, like air. It is measured in Hertz. **Misconceptions** Students may think that energy can be produced or lost as it is transferred and transformed. Remind students that energy cannot be created or destroyed. It moves between objects and changes from one form to another.		**Additional Resources** Lesson: Energy Makes "What" Happen? Lesson: Energy Concept Map Simulation: Roller Coaster Simulation Lab: Ball Bounce Lab **ESL Supports and Scaffolds** WIDA Standard 4- The Language of Science To support students in speaking, refer to this resource: WIDA Doing and Talking Science Use graphic organizers or concept maps to support students in their analysis of why things move. To support students when they design their device: **Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.** Question Starters What's the connection between….? What link do you see between… Why do you think…? What is our evidence that….

		Do we have enough evidence to make that claim? But what about this other evidence that shows…? But does your claim account for…(evidence) <u>Response Starters</u> I agree with you because of (evidence or reasoning) I don't agree with your claim because of (evidence or reasoning) This evidence shows that… Your explanation makes me think about Description sentence stems: I observed . The has . I noticed . It reminds me of , because .

3rd Grade Quarter 2 Curriculum Map Quarter 2 Curriculum Map Feedback							
Quarter 1			**Quarter 2**	Quarter 3		Quarter 4	
Structure and Procedure	Unit 1 Matter	Unit 2 Magnetic Forces	**Unit 3 Energy**	Unit 4 Solar System	Unit 5 Weather and Climate	Unit 6 Types of Living Things	Unit 7 Survival of Animals and Plants
1 week	5 weeks	3 weeks	**9 weeks**	3 weeks	6 weeks	3 weeks	6 weeks

UNIT 3: Energy (9 weeks)
Overarching Question(s)
How is energy transferred and conserved?

Unit 3: Energy, Lesson 2	**Lesson Length**	**Essential Question**	**Vocabulary**
Circuits	3 weeks	How do you convert electrical energy to other forms of energy?	charged particles, electrical current, circuit

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI(s) 3.PS3. Energy **Standard(s)** 3.PS3.2: Apply scientific ideas to design, test, and refine a device that converts electrical energy to another form of energy, using open or closed simple circuits. **Explanation and Support of Standard** 3.PS3.2 Electric currents are a way to transfer energy from one location (e.g., a battery) to another device in the	**Learning Outcomes** Students will make open and closed circuits and demonstrate the conversion of electrical current to other energy forms. **Suggested Phenomenon:** *Click on the phenomenon picture to view the video.*	**Curricular Resources** <u>Engage</u> TE, p. 259-260 TE, Phenomenon, p. 259 Be a Scientist Notebook, p.271, Phenomenon TE, Essential Question: p. 260 TE, Science and Engineering Practices: p. 260 <u>Explore</u> TE, pp. 260-261

circuit (e.g. a lightbulb, motor, or speaker). The energy-carrying current can be used to produce the energy indicators listed in 3.PS3.1: motion, sound, light, and heat. Hand-crank generators are a powerful tool to extend this standard to the concept that the energy of motion can be transformed into an energy-carrying current. This small demonstration should help to explain that turbines can be used to make energy-carrying currents in dams or other hydroelectric applications. *(The focus of this standard should remain on the ability of currents to carry energy. Open and closed circuits are an application to build context around this understanding.)* **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information **Suggested Crosscutting Concept(s)** Energy and Matter **Teacher Overview** Energy can be transformed from one form to another, such as potential energy to kinetic energy or mechanical energy to electrical energy. Electrical energy can then be transformed into other forms of energy, such as light, heat, and sound energy. The law	 Phenomenon Explanation: The picture of the working flashlight helps students to see that once electricity is inside a closed circuit, it continues to travel until it reaches a break (the off switch). The flashlight can be turned off by breaking the circuit.	*(LAB)* Be a Scientist Notebook, p. 273, Inquiry Activity: Human Circuit Explain TE, pp. 261-266 Be A Scientist Notebook, p. 274: Vocabulary Science File: Circuits Digital Interactive: Electric Current in a Circuit *(LAB)* Be A Scientist Notebook, p. 276, Inquiry Activity: Simple Circuits Digital Interactive: Energy Sequence Elaborate TE, pp. 266-267 Science Handbook/eBook: Conductors and Insulators. Evaluate TE, pp. 267-269 *(LAB)* Be A Scientist Notebook, p.281 Performance Task: Make It Work eAssessment **Additional Resources** Lesson: Circuits with Friends National Geographic Lesson: Building Circuits

of conservation of energy states that energy can only be transformed. It cannot be created or destroyed. **Misconceptions** Students may be confused by the fact that they have studied different forms of energy, and they may not be aware that one kind of energy can be transformed into other forms. They may be confused about how current electricity is generated, especially if they have studied static electricity. Explain that in this lesson they will make observations that show that electric currents transfer energy.		Lesson: Parallel Circuits Day 1 Lesson: Parallel Circuits Day 2 Project: Complete Circuit: How Does a Flashlight Work? Video: The Power of Circuits Video: Explaining an Electrical Circuit Video: Electrical Circuits - Series and Parallel **ESL Supports and Scaffolds** WIDA Standard 4- The Language of Science To support students in speaking, refer to this resource: WIDA Doing and Talking Science Use graphic organizers or concept maps to support students in their descriptions of open and closed circuits. To support students when they work with circuits: **Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.** Question Starters What's the connection between….? What link do you see between…

		Why do you think…? What is our evidence that…. Do we have enough evidence to make that claim? But what about this other evidence that shows…? But does your claim account for…(evidence) <u>Response Starters</u> I agree with you because of (evidence or reasoning) I don't agree with your claim because of (evidence or reasoning) This evidence shows that… Your explanation makes me think about Description sentence stems: I observed . The has . I noticed . It reminds me of , because .

3rd Grade Quarter 2 Curriculum Map

Quarter 2 Curriculum Map Feedback

Quarter 1			**Quarter 2**	Quarter 3		Quarter 4	
Structure and Procedure	Unit 1 Matter	Unit 2 Magnetic Forces	**Unit 3 Energy**	Unit 4 Solar System	Unit 5 Weather and Climate	Unit 6 Types of Living Things	Unit 7 Survival of Animals and Plants
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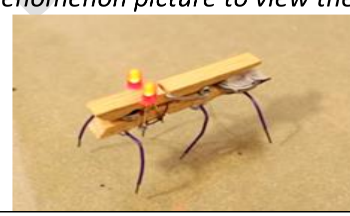
UNIT 3: Energy (9 weeks)

Overarching Question(s)

How is energy transferred and conserved?

Unit 3: Energy, Lesson 3	**Lesson Length**	**Essential Question**	**Vocabulary**
Design Energy Solutions	3 weeks	What kinds of problems can be solved by understanding energy transfer?	design process, criteria, prototype, constraint

Standards and Related Background Information	**Instructional Focus**	**Instructional Resources**
DCI(s) 3.PS3.Energy 3.ETS1: Engineering Design 3.ETS2: Links Among Engineering, Technology, Science, and Society **Standard(s)** 3.PS3.2: Apply scientific ideas to design, test, and refine a device that converts electrical energy to another form of energy, using open or closed simple circuits.	**Learning Outcomes** Students will design a device that applies the scientific idea that energy can be transferred from one object to another. Students will design a device that shows several ways in which energy can be transferred. **Suggested Phenomenon:** *Click on the phenomenon picture to view the video.* 	**Curricular Resources** <u>Engage</u> TE, p. 271-272 TE, Phenomenon, p. 271 Be a Scientist Notebook, Phenomenon, p. 285 Essential Question, TE: p. 272 Science and Engineering Practices, TE: p.272 <u>Explore</u> TE, pp. 273-274

3.ETS1.1: Design a solution to a real-world problem that includes specified criteria for constraints. 3.ETS1.2: Apply evidence or research to support a design solution. 3.ETS2.1: Identify and demonstrate how technology can be used for different purposes. **Explanation and Support of Standard** 3.PS3.2 Electric currents are a way to transfer energy from one location (e.g., a battery) to another device in the circuit (e.g. a lightbulb, motor, or speaker). The energy-carrying current can be used to produce the energy indicators listed in 3.PS3.1: motion, sound, light, and heat. Hand-crank generators are a powerful tool to extend this standard to the concept that the energy of motion can be transformed into an energy-carrying current. This small demonstration should help to explain that turbines can be used to make energy-carrying currents in dams or other hydroelectric applications. *(The focus of this standard should remain on the ability of currents to carry energy. Open and closed circuits are an application to build context around this understanding.)*	Simple Robot Phenomenon Explanation: The mini robot bug demonstrates the design of an engineered device that models energy being transferred from one form to another.	*(LAB)* Be a Scientist Notebook, p. 287, Inquiry Activity: It's Too Loud in Here! Explain TE, pp. 274-279 *(LAB)* Be A Scientist Notebook, p. 289: Vocabulary Science File: Keep It Cool Digital Interactive: The Design Process Science File: The Design Process in Action Elaborate TE, pp. 279-280 Video: Technology and Energy Transfer *(LAB)* Be a Scientist Notebook, p. 296, Inquiry Activity: Technology and Energy Transfer Evaluate TE, pp. 281-283 *(LAB)* Be a Scientist Notebook, p. 297 Performance Task: It's Too Cold in Here! eAssessment **Additional Resources** Lesson: Power Up! Video: Intro to Design Process Video: Energy Transfer by Electricity, Light, Sound & Heat Video: Energy Transformation

3.ETS1.1 Design problems defined to address a change opportunity should include observations about the situation or environment. The insights gained when making preliminary observations of a situation to be improved should be used to define specific criteria for successful solutions and constraints which might limit possible design solutions. Criteria are the required specifications/performances must meet to be deemed successful. Constraints are the limitations placed on potential designs due to real-world factors that cannot be changed. Constraints might include limited availability of either materials or non-material resources (e.g., time, access). Understanding these constraints, students can now undertake the task of comparing design solutions and then consider how well the proposals meet criteria for success and work within the constraints. 3.ETS1.2 Engineers research a problem before they begin working on a design solution. Examples of the potential research types could include internet searches, market research (to gauge potential interest in the solution), or field observations. 3.ETS2.1		Video: How Does Energy Convert? Video: Bill Nye Energy WIDA Standard 4- The Language of Science To support students in speaking, refer to this resource: WIDA Doing and Talking Science Provide sequencing sentences frames as students design their devices: First I…. Next,….. After that….. To support students when they work with circuits: **Model speaking and writing expectations for Entering Level ELs. Consider using the recommended stems to support students in their discussions and writing.** Question Starters What's the connection between….? What link do you see between… Why do you think…? What is our evidence that…. Do we have enough evidence to make that claim?

As scientific understanding of the natural world increases, these understandings can lead to improvements in engineered objects. In turn, improvements the tools produced by engineers can enable further discovery by scientists. Scientists utilize devices produced by engineers in innovative ways that may have never been considered initially. Examples of this concept might include using a cell phone as an interactive map of the night sky or apps such as eBird (Cornell University) which can be used to track and catalog sightings of birds using the user's GPS location. **Suggested Science and Engineering Practice(s)** Obtaining, Evaluating, and Communicating Information Constructing Explanations and Designing Solutions Developing and Using Models **Suggested Crosscutting Concept(s)** Energy and Matter **Teacher Overview** Scientific ideas can be used to develop solutions to practical problems. The design process begins by establishing criteria for evaluating the proposed solution to determine whether it solves the problem. Constraints on the process include the availability of resources, time needed to complete the process, and ability to carry out the proposed solution. Engineers		But what about this other evidence that shows…? But does your claim account for…(evidence) <u>Response Starters</u> I agree with you because of (evidence or reasoning) I don't agree with your claim because of (evidence or reasoning) This evidence shows that… Your explanation makes me think about

and scientists often build a prototype, or model, in order to evaluate the solution. **Misconceptions** Students working on an engineering project may look for the “right” answer. Make sure they understand that there may be more than one correct answer or solution to an engineering design challenge. In general, there are many possible solutions. The applicability of any particular solution must be evaluated as part of the process. A usable design will solve the problem within the constraints of resources and time. Other ideas may solve the problem as well as or better but may not be feasible within the constraints of time and money.		