EDUCATION STANDARDS CORRELATIONS FOR LONGITUDINAL AND TRANSVERSE WAVES

CORRELATION TO THE SOUTH CAROLINA CURRICULUM STANDARDS

Science Inquiry:
- All SCEPP modules are inquiry-based, addressing multiple Science Inquiry standards.

Physical Science:
- Compare and contrast models of longitudinal and transverse waves [IV.(physics).C.1.b].

Earth/Space Science:
- Predict changes in the Earth surface based on past and present geologic events (III.C.3.d).
- Trace the historical development of the theory of plate tectonics including the contributions of Wegener (III.C.3.e).

Mathematics:
- Use tables and graphs as tools, including technology where appropriate (II.B).
- Deduce properties of figures using coordinate systems (IV.G).
- Construct and draw inferences from charts, tables, and graphs that summarize data from real-world situations, using technology where appropriate (VI.G).

CORRELATION TO THE
SOUTH CAROLINA PHYSICAL SCIENCE COURSE STANDARDS

Science Inquiry:

- Select and use appropriate instruments to make the observations necessary for the investigation, taking into consideration the limitations of the equipment. [I.B.2.]
- Organize and display data in useable and efficient formats, such as tables, graphs, maps, cross sections, and mathematical expressions. [I.B.6.]
- Draw conclusions based on qualitative and/or quantitative data. [I.B.7]
- Select and use appropriate technologies (e.g., computers, calculators, calculator -based laboratories [CBLs], electronic balances, calipers) to achieve appropriate precision and accuracy of data collection, analysis, and display.[I.C.1]
- Construct scientific explanations or models (physical, conceptual, and mathematical) by using discussion, debate, logic, and experimental evidence. [I.D.1.]
- Develop explanations and models that demonstrate scientific integrity. [I.D.2.]

Physical Science:

- Identify and show relationships among wave characteristics such as velocity, period, frequency, amplitude, and wavelength using the formula $v=f\lambda$ [III.(physics).C.1.a].
- Compare and contrast models of longitudinal waves (e.g. sound waves, seismic waves) and transverse waves (e.g. electromagnetic waves, water waves).[III.(physics).C.1.b].
- Distinguish among the electromagnetic spectrum, seismic waves, water waves, and sound waves on the basis of their properties and behaviors. [III.(physics).C.1.c].

CORRELATION TO THE NATIONAL SCIENCE EDUCATION STANDARDS

Inquiry:

- Identify questions and concepts that guide scientific investigations:

  Students should formulate a testable hypothesis and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment. They should demonstrate appropriate procedures, a knowledge base, and conceptual understanding of scientific investigations.

- Design and conduct scientific investigations:

  Designing and conducting a scientific investigation requires introduction to the major concepts in the area being investigated, proper equipment, safety precautions, assistance with methodological problems, recommendations for use of technologies, clarification of ideas that guide the inquiry, and scientific knowledge obtained from sources other than the actual investigation. The investigation may also require student clarification of the question, method, controls, and variables; student organization and display of data; student revision of methods and explanations; and a public presentation of the results with a critical response from peers. Regardless of the scientific investigation performed, students must use evidence, apply logic, and construct an argument for their proposed explanations.

- Use technology and mathematics to improve investigations and communications:

  A variety of technologies, such as hand tools, measuring instruments, and calculators, should be an integral component of scientific investigations. The use of computers for the collection, analysis, and display of data is also a part of this standard. Mathematics plays an essential role in all aspects of an inquiry. For example, measurement is used for posing questions, formulas are used for developing explanations, and charts and graphs are used for communicating results.

- Formulate and revise scientific explanations and models using logic and evidence:

  Student inquiries should culminate in formulating an explanation or model. Models should be physical, conceptual, and mathematical. In the process of answering the questions, the students should engage in discussions and arguments that result in the revision of their explanations. These discussions should be based on scientific knowledge, the use of logic, and evidence from their investigation

- Recognize and analyze alternative explanations and models:

  This aspect of the standard emphasizes the critical abilities of analyzing an argument by reviewing current scientific understanding, weighing the evidence, and examining the logic so as to decide which explanations and models are best. In other words, although there may be several plausible explanations, they do not all have equal weight. Students should be able to use scientific criteria to find the preferred explanations.

- Communicate and defend a scientific argument:

  Students in school science programs should develop the abilities associated with accurate and effective communication. These include writing and following procedures, expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts, explaining statistical analysis, speaking clearly and logically, constructing a reasoned argument, and responding appropriately to critical comments.

- Understandings about scientific inquiry:

  Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used.

  Mathematics is essential in scientific inquiry. Mathematical tools and models guide and improve the posing of questions, gathering data, constructing explanations and communicating results.

  Results of scientific inquiry--new knowledge and methods--emerge from different types of investigations and public communication among scientists. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. In addition, the methods and procedures that scientists used to obtain evidence must be clearly reported to enhance opportunities for further investigation.

Physical Science:

- Interactions of energy and matter:

  Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

Earth and Space Science:

- Energy in the earth system:

  The outward transfer of earth's internal heat drives convection circulation in the mantle that propels the plates comprising earth's surface across the face of the globe.

- The origin and evolution of the earth system:

  Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.

Science and Technology:

- Propose designs and choose between alternative solutions:

  Students should be introduced to the roles of models and simulations in these processes.

- Communicate the problem, process, and solution:

  Students should present their results to students, teachers, and others in a variety of ways, such as orally, in writing, and in other forms--including models, diagrams, and demonstrations.

Science in Personal and Social Perspectives:

- Natural and human-induced hazards:

Normal adjustments of earth may be hazardous for humans. Humans live at the interface between the atmosphere driven by solar energy and the upper mantle where convection creates changes in the earth's solid crust. As societies have grown, become stable, and come to value aspects of the environment, vulnerability to natural processes of change has increased.

Natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society, as well as cause risks. Students should understand the costs and trade-offs of various hazards--ranging from those with minor risk to a few people to major catastrophes with major risk to many people. The scale of events and the accuracy with which scientists and engineers can (and cannot) predict events are important considerations.