

Vertical Alignment of Scientific and Engineering Practice: Developing and Using Models and Prototypes

TEKS in Focus highlights key concepts and student expectations to assist educators in implementing the Texas Essential Knowledge and Skills (TEKS) in science. The vertical progression of a concept within the science TEKS is presented, along with detailed explanations from the TEKS Guide. The scientific and engineering practices are the first strand of the science TEKS. To create a cohesive learning experience, educators should integrate scientific and engineering practices with content. Embedding these practices in the content provides students with the context to ask questions, develop models, and analyze data. This approach ensures that students develop critical thinking and problem-solving skills by applying scientific and engineering practices to real-world scenarios as they learn the content.

Detailed explanations are provided for the underlined terms and phrases in each student expectation. Detailed explanations call out a specific word or phrase in a student expectation to clarify what students should know and be able to do in reference to that word or phrase. Detailed explanations may include an instructional boundary that specifies Tier 1 (baseline) instructional expectations for all students.

Scientific and Engineering Practice 1G

Science TEKS	Term or Phrase	Detailed Explanations from TEKS Guide
K.1.G, 1.1.G, 2.1.G, 3.1.G, 4.1.G, 5.1.G develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.	develop and use models	Students should experience a variety of models related to scientific concepts. Some examples of models are drawings, flowcharts, simulations, and physical models from materials such as clay. Students should be encouraged to use similar models to represent phenomena, objects, and processes as part of learning about grade-level science concepts.
6.1.G, 7.1.G, 8.1.G, Bio.1.G, Chem.1.G, IPC.1.G, Phys.1.G develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and	develop and use models	Students should develop a variety of models to explain their thinking about phenomena, objects, and processes found in grade-level or course-specific science concepts. Some examples of models are drawings, flowcharts, simulations, and physical models from materials such as clay.
K.1.G, 1.1.G, 2.1.G, 3.1.G, 4.1.G, 5.1.G develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.	processes	Students understand that processes describe the steps followed or actions taken to achieve a specific end, the way things occur, or how something is created. Processes are repeatable under the same conditions.
K.1.G, 1.1.G, 2.1.G, 3.1.G, 4.1.G, 5.1.G develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.	prototype	Students should understand that prototypes are used to collect data on potential solutions to problems. If students build a prototype, they can collect data on whether their solution solves the problem. Students will use models (prototypes) as engineers to define problems by asking questions, identifying flaws, limitations, and strengths, and testing possible solutions.

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6.1.G, 7.1.G, 8.1.G, Bio.1.G, Chem.1.G, IPC.1.G, Phys.1.G develop and use models to represent phenomena, systems, processes, or solutions to engineering problems ; and	solutions to engineering problems	Students should understand that prototypes are used to collect data on potential solutions to problems. If students build a prototype, they can collect data on whether their solution solves the problem. Students will use models (prototypes) as engineers to define problems by asking questions, identifying flaws, limitations, and strengths, and testing possible solutions.

TEKS Guide Glossary Terms (found in one or more student expectations of this vertical alignment):

Glossary terms and definitions are consistent across kindergarten through high school in the TEKS Guide. The definitions are intended to provide educators with a common understanding of the terms, regardless of the grade level they teach. Glossary definitions are not intended for use with students.

phenomena: detectable events that are observed through the senses or technology; can be explained through scientific laws, ideas, principles, and theories

prototype: a first or preliminary model of something from which other iterations are developed or copied

system: a regularly interacting or interdependent group of items forming a unified whole

TEKS Guide Further Explanations:

The further explanation section is meant to serve as a resource to help educators better understand the topic their students are studying. Further explanations may be written at a level more complex than what is expected for students at that grade level.

Models:

Both scientists and engineers use a variety of models. Physical models show how things look or work in the real world. Conceptual models represent relationships and describe how things work or fit together. Mathematical models use mathematical equations, theories, formulas, and proofs. Simulations allow for the control of variables and mimic real-world processes. Examples of models include sketches, diagrams, mathematical relationships, simulations, and physical models, and are used to make predictions about the behavior of a system.

Processes:

Natural processes such as life cycles, weather, or the rock cycle, can be represented with conceptual, physical, mathematical, or simulated models. In engineering, the solution to a design challenge could be a new or improved process shown with a model or diagram.

Prototype:

Prototypes are a subset of models that serve a specific purpose. Models are usually created after data is collected and are used to explain systems or processes. Models can be used to communicate findings to the target audience. Prototypes are usually created as an early step in determining why a system is not working or to try to improve a design. They are not typically shared with the broader public once the problem has been solved.

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