



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

TEKS in Focus highlights key concepts and student expectations to help educators implement the Texas Essential Knowledge and Skills (TEKS) in science. It presents the vertical progression of a concept within the science TEKS, 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 content gives students 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 3A

Science TEKS	Term or Phrase	Detailed Explanations from TEKS Guide
K.3.A, 1.3.A, 2.3.A, 3.3.A, 4.3.A, 5.3.A <u>develop explanations and propose solutions supported by data and models;</u>	develop explanations and propose solutions	As scientists, students will work to propose age-appropriate explanations for their observations of the world around them. As young engineers, students will propose solutions to problems. Students should understand that there are often multiple possible solutions to a problem, and the solution chosen at any given time will depend on the criteria used to evaluate those solutions; what works well in one circumstance may not work in another.
	models	Students should experience a variety of models related to scientific and engineering concepts. Students should use models of phenomena, systems, cycles, processes, relationships, and structures to support their explanations as scientists. For example, life cycles could be modeled with a drawing, a flowchart, a simulation, or a clay model. Students will use models (prototypes) as engineers to test possible solutions.

Science TEKS	Term or Phrase	Detailed Explanations from TEKS Guide
6.3.A, 7.3.A, 8.3.A, BIO.3.A, CHEM.3.A, IPC.3.A, PHYS.3.A <u>develop explanations and propose solutions</u> <i>supported by data and models and consistent with scientific ideas, principles, and theories;</i>	develop explanations and propose solutions	As scientists, students should develop age-appropriate explanations for their observations of phenomena. As young engineers, students should propose solutions to problems. Students should understand that there are often multiple possible solutions to a problem, and the solution chosen at any given time will depend on the criteria used to evaluate those solutions; what works well in one circumstance may not work in another. Student explanations should be supported by evidence from data or models.
	models	Students should develop and use a variety of models related to scientific and engineering concepts. Students should use models of phenomena, systems, cycles, processes, relationships, and structures to support their explanations as scientists. For example, life cycles could be modeled with a drawing, a flowchart, a simulation, or a diorama. Students will use models (prototypes) as engineers to test possible solutions.

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

Glossary terms and definitions in the TEKS Guide are consistent from kindergarten through high school. The definitions 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.

data: factual information (such as observations, measurements, or statistics) used as a basis for reasoning, discussion, or calculation; often includes both useful and irrelevant or redundant information and must be processed to be meaningful

scientific principle: a qualitative description of how a specific phenomenon works which is generally accepted by the scientific community

scientific idea: a general scientific concept, supported by evidence, that aids in defining the nature of an object or in defining a process and is adapted as new evidence is discovered

scientific theory: a well-established and highly reliable explanation that is based on natural and physical phenomena and is capable of being tested by multiple independent researchers; may be subject to change as new areas of science and new technologies are developed; explain why phenomena occur

TEKS In Focus highlights concepts or student expectations to strengthen TEKS alignment, rigor, and shared understanding. It doesn't specify a particular order or timing but helps clarify TEKS expectations and serves as a guide for classroom instruction when relevant.

TEKS Guide Further Explanation:

The further explanation section is intended 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.

The following further explanation appears in kindergarten through grade 12:

Explanations and solutions:

[Engineering design](#) is a systematic process for solving engineering problems. It starts with scientific knowledge and models of the material world. Each proposed solution balances competing criteria — desired functions, technological feasibility, cost, safety, esthetics, and compliance with legal requirements.

Models:

Both scientists and engineers use 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 mimic real-world processes and allow variables to be controlled. Examples of models include sketches, diagrams, mathematical relationships, simulations, physical models, and prototypes, which are used to predict a system's behavior.