TEKS IN FOCUS

Explaining the difference between science and engineering.

Each month *TEKS in Focus* will highlight key concepts and student expectations from the 2024 Texas Essential Knowledge and Skills (TEKS), emphasizing the newly introduced engineering standards. Students will learn to distinguish between the objectives of science and engineering. The accompanying table outlines updates to the science TEKS, particularly the expansion of student inquiry to include problem solving, alongside traditional observation and investigation-based questions to understand the natural world.

Focus on Asking Questions in Science TEKS

Level of Study	Prior TEKS	TEKS Implemented in 2024
Elementary	1.2.A ask questions about organisms, objects, and events observed in the natural world;	1.1.A ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
Middle School	7.2.B design and implement experimental investigations by making observations, asking well defined questions, formulating testable hypotheses, and using appropriate equipment and technology;	7.1.A ask questions and define problems based on observations or information from text, phenomena, models, or investigations;
High School	B.2.E plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;	B.1.A ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

Changes in Questioning

Currently, students learn science by asking questions and finding answers about the natural world. The new science TEKS add engineering practices. The difference between science and engineering is the purpose of the work: scientists want to explain phenomena and engineers want to solve problems. Students will explore the natural world by asking questions about phenomena and defining engineering problems, learning science content along the way.

Adjusting Practice

As students observe various phenomena, teachers should encourage students to ask questions that lead to explaining phenomena or defining problems. Identifying the purpose of the question assists learners in understanding the differences between scientists and engineers. Keeping a chart of questions organized by purpose can allow students to identify patterns and create space for discussion about the similarities and differences in the behaviors of scientists and engineers.

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Focus: Developing and Using Models in Science TEKS

Level of Study	Prior TEKS	TEKS Implemented in 2024
Elementary	2.4 The student uses age-appropriate tools and models to investigate the natural world	2.2.A identify basic advantages and limitations of models such as their size, properties, and materials; 2.3.A develop explanations and propose solutions supported by data and models;
Middle School	6.3.B use models to represent aspects of the natural world such as a model of Earth's layers; 6.3.C identify advantages and limitations of models such as size, scale, properties, and materials	6.1.G develop and use models to represent phenomena, systems, processes, or solutions to engineering problems 6.2.A identify advantages and limitations of models such as their size, scale, properties, and materials 6.3.A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
High School	BIO.3.E evaluate models according to their limitations in representing biological objects or events; and	BIO.1.G develop and use models to represent phenomena, systems, processes, or solutions to engineering problems BIO.2.A identify advantages and limitations of models such as their size, scale, properties, and materials BIO.3.A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories

Changes in Developing and Using Models

Students currently learn to represent the natural world using models and analyze models for advantages and limitations as scientists. The science TEKS being implemented in 2024 expand student expectations to include developing, using, and analyzing models as engineers. Recognizing the purpose of the work is the key to distinguishing scientific practice from engineering design; scientists explain phenomena, and engineers solve problems related to phenomena**.** Scientists use models to explore the interdependence of parts within a system and to develop explanations about the phenomenon observed. Engineers use models, specifically prototypes, to test their designs related to solving an engineering problem. In both science and engineering, students are now asked to develop models and use them as evidence to support a claim or to justify a solution.

Adjusting Practice

While students are learning and asking questions about new science ideas, teachers can encourage them to develop models that will help them understand or explain a phenomenon or provide a prototype of a design that can be tested. Teachers should continually ask questions such as "What does this model allow me to see?" and "What does this model not allow me to see?" Students should be encouraged to share the limitations and advantages of the model when using it as evidence to support their explanation or solution.

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Focus: Planning and Carrying Out Investigations in Science TEKS

Level of Study	Prior TEKS	TEKS Implemented in 2024
Elementary	3.2.A plan and implement **descriptive investigations**, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;	3.1.B use scientific practices to plan and conduct **descriptive investigations** and use **engineering practices to design solutions** to problems;
Middle School	7.2.A plan and implement **comparative and descriptive investigations** by making observations, asking well defined questions, and using appropriate equipment and technology; 7.2.B design and implement **experimental investigations** by making observations, asking well defined questions, formulating testable hypotheses, and using appropriate equipment and technology;	7.1.B use scientific practices to plan and conduct **descriptive, comparative, and experimental investigations** and **use engineering practices to design solutions** to problems;
High School	PHYS.2.D **design and implement investigative procedures**, including making observations, asking well defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, evaluating numerical answers for reasonableness, and identifying causes and effects of uncertainties in measured data;	PHYS.1.B apply scientific practices to plan and conduct **descriptive, comparative, and experimental investigations**, and **use engineering practices to design solutions** to problems;

Changes in Planning and Carrying Out Investigations

The science TEKS to be implemented in 2024 expand student expectations to include using investigations to design solutions to problems as engineers. Key to distinguishing scientific practice from engineering design is the purpose of the work; scientists design investigations to develop explanations of phenomena and test hypotheses, and engineers design investigations to test prototypes of their proposed solutions**.** Both scientists and engineers must identify variables, decide what will be measured and recorded, and analyze data. Engineers use investigations to test their designs related to solving an engineering problem.

Adjusting Practice

The use of scientific investigations integrates with the use of engineering designs to solve problems. Students may be asked to investigate a phenomenon to develop an understanding of the related science concept and then be asked to apply this understanding to design and test a solution to a problem related to the phenomenon. Students also may be asked to design and test a solution to a problem that uncovers a scientific phenomenon to be investigated for understanding. Identifying the language within the purpose of the investigation assists students in identifying their roles as scientists and engineers.

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TEKS IN FOCUS

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Focus: Analyzing and Interpreting Data in Science TEKS

Level of Study	Prior TEKS	TEKS Implemented in 2024
Elementary	4.2.C construct simple tables, charts, bar graphs, and maps using tools and current technology to organize, examine, and evaluate data; 4.2.D analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured;	4.2.B analyze data by identifying any significant features, patterns, or sources of error; 4.2.C use mathematical calculations to compare patterns and relationships; and 4.2.D evaluate a design or object using criteria.
Middle School	8.2.D construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and 8.2.E analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.	8.2.B analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations; 8.2.C use mathematical calculations to assess quantitative relationships in data; and 8.2.D evaluate experimental and engineering designs.
High School	IPC.2.C collect data and make measurements with accuracy and precision; IPC.2.D organize, analyze, evaluate, make inferences, and predict trends from data; IPC.3.C draw inferences based on data related to promotional materials for products and services;	IPC.2.B analyze data by identifying significant statistical features, patterns, sources of error, and limitations; IPC.2.C use mathematical calculations to assess quantitative relationships in data; and IPC.2.D evaluate experimental and engineering designs.

Changes in Analyzing and Interpreting Data

In science, students use data to support an explanation of a phenomenon. The science TEKS to be implemented in 2024 expand student expectations to include using data to determine how well a solution meets the expected criteria and to compare solutions to problems as engineers. Key to distinguishing scientific practice from engineering design is the purpose of the work; scientists explain phenomena, and engineers solve problems related to phenomena. Both scientists and engineers must use a variety of tools to collect and analyze data, as well as use multiple representations of the data to support analysis and interpretation. Engineers use data analysis to determine how efficient and effective a solution is in regard to an engineering problem.

Adjusting Practice

Engineering problems have both criteria and constraints. For example, to address the need for clean drinking water while hiking in remote locations, an engineer might design a freshwater filtration device that is lightweight, portable, and cost-effective while also filtering out harmful bacteria to address the need of drinking water when hiking in remote locations. The data collected from investigations allow engineers to compare designs for weight, portability, cost, and degree of filtration. As engineers, students will consider what needs their solutions should address. Some constraints and criteria may be provided by the teacher or developed in collaboration with the teacher prior to designing and testing solutions. Students will use the data collected to determine how well their design meets the criteria and constraints.

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Focus: Using Evidence for Scientific Argumentation

Level of Study	Prior TEKS	TEKS Implemented in 2024
Elementary	5.2.D analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence; 5.3.A analyze, evaluate, and critique scientific explanations by using evidence, logical reasoning, and experimental and observational testing;	5.3.A develop explanations and propose solutions supported by data and models; 5.3.C listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion.
Middle School	6.2.E analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends. 6.3.A analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	6.3.A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; 6.3.C engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.
High School	PHYS.2.I communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports; and PHYS.3.A analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	PHYS.3.A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; PHYS.3.C engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

Changes in Using Evidence for Scientific Argumentation

Student expectations now include using evidence as engineers to support claims about their solutions, such as how they meet criteria and constraints, budget, efficiency, or longevity. Key to distinguishing scientific practice from engineering design is the purpose of the work; scientists explain phenomena, and engineers design solutions to problems to positively impact society.

Scientific argumentation is the process of respectfully discussing and debating claims based on evidence. Scientific progress is made when scientists critique each other's interpretation of data, and the scientific community comes to a consensus about a topic. It is through this debate and discussion that scientific ideas, theories, and laws are acknowledged and accepted. Engineers engage in argumentation with their design team to improve their designs and document the effectiveness of their products. An engineering design team may use arguments about cost-effectiveness, risk, aesthetics, and user preferences to select design elements for their solution.

Adjusting Practice

To create the conditions for respectful discussion and debate, it is important to develop norms and model processes that place emphasis on claims using evidence. Stating claims with emphasis on evidence helps remove bias, thus encouraging healthy argumentation. Sentence frames and organizers, such as a Claim-Evidence-Reasoning model, can provide scaffolded support. In addition, it is helpful to create an explicit culture where classmates may critique ideas and interpretations of data but not people.

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Focus: Evaluating and Communicating Information

Level of Study	Prior TEKS	TEKS Implemented in 2024
Elementary	3.2.F **communicate valid conclusions supported by data** in writing, by drawing pictures, and through verbal discussion. 3.3.A **analyze, evaluate, and critique scientific explanations** by using evidence, logical reasoning, and experimental and observational testing;	3.3.B **communicate explanations and solutions** individually and collaboratively in a variety of settings and formats; and 3.3.C **listen actively to others' explanations to identify relevant evidence** and engage respectfully in scientific discussion.
Middle School	7.2.E analyze data to formulate reasonable explanations, **communicate valid conclusions supported by the data,** and predict trends. 7.3.A **analyze, evaluate, and critique scientific explanations** by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	7.3.B **communicate explanations and solutions** individually and collaboratively in a variety of settings and formats; and 7.4.B **make informed decisions by evaluating evidence from multiple appropriate source**s to assess the credibility, accuracy, cost-effectiveness, and methods used; and
High School	BIO.2.H **communicate valid conclusions supported by the data** through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports. BIO.3.A **analyze, evaluate, and critique scientific explanations** by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;	BIO.3.B **communicate explanations and solutions** individually and collaboratively in a variety of settings and formats; and BIO.4.A **analyze, evaluate, and critique scientific explanations and solutions** by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;

Changes in Evaluating and Communicating Information

The new science TEKS have broadened the formats that students will use to communicate and have added attention to the settings where students share their findings. Students are also expected to communicate explanations and solutions, and evaluate or critique explanations and solutions, emphasizing the communication purposes of scientists and engineers.

Adjusting Practice

Communication involves both sharing and receiving messages. Scientists and engineers share their findings and evaluate the findings of others through written, visual, and verbal formats. It is important for communication to be precise, clearly stated, and justified with evidence. Providing students with a Claim-Evidence-Reasoning frame can support them in sharing their findings. Using a variety of settings in the classroom and out of the classroom should be considered. Within the classroom, students can communicate individually, with a peer, with a group or with the class. Out of the classroom, students may share their communications at a school event, for a local business or organization, or through a vetted website. Helping students to evaluate information for credibility begins with identifying relevant data. Students may use a Claim-Evidence-Reasoning frame to deconstruct an argument.

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