EbD™ TEEMS NxtGen – PreK-6
Elementary STEM At-A-Glance

The Engineering byDesign™ Program is built on the belief that the ingenuity of children is untapped, unrealized potential that, when properly motivated, will lead to the next generation of technologists, innovators, designers, and engineers.

The International Technology and Engineering Educators Association's STEM Center for Teaching and Learning™ has developed the only standards-based national model for Grades K-12 that delivers technological literacy in a STEM context.

The model, Engineering byDesign™ is built on the Common Core State Standards (High School / Middle School), Next Generation Science Standards (K-12), Standards for Technological Literacy (ITEEA); Principles and Standards for School Mathematics (NCTM); and Project 2061, Benchmarks for Science Literacy (AAAS). Additionally, the Program K-12 has been mapped to the National Academy of Engineering's Grand Challenges for Engineering.

Using constructivist models, students participating in the program learn concepts and principles in an authentic, problem/project-based environment. Through an integrative STEM environment, EbD™ uses all four content areas as well as English-Language Arts to help students understand the complexities of tomorrow.

The ITEEA STEM Center for Teaching and Learning preK-6 elementary STEM curriculum unit sequence is delivered through a hands-on **T**echnology, **E**ngineering, **E**nvironment, **M**athematics, and **S**cience (TEEMS) thematic interdisciplinary approach using an engaging, Integrative STEM Education lessons.

EbD™ TEEMS NxtGen – PreK
At-A-Glance

Intended Audience: PreK (ages 3-4) **Course Length: 6-8 weeks**

In this TEEMS Building Block, preschool students will be introduced to the life cycles of plants, butterflies, and frogs. They will use a multisensory approach as they plant and observe seed growth, experience hands-on lessons, enjoy literature, and share with teachers and students the circle of life.

Objectives

- Students will be able to identify a seed as the origin of a plant and demonstrate the sequence of events in the life cycle of a plant.
- Recognize similarities between characters/situations in a narrative and their own life experiences.
- Identify the similarities/differences between a plant's life cycle parts and a human's life cycle.
- Students will use new vocabulary words to describe the life cycle of a plant.
- Identify a terrarium and its purpose and list key differences between natural and human-made objects.
- Observe, describe, compare, and categorize human-made objects found discarded outdoors.
- Students will be better able to illustrate their understanding of the different parts of a plant and how a plant grows from a seed.
- Students will investigate seeds and make predictions about plant growth.
- Plant and water seeds and observe their sprouts and roots as they grow.
- Continue to develop an understanding of how a plant grows from a seed.
- Demonstrate or explain the life cycle of a butterfly.
- Recognize similarities between characters/situations in a narrative and their own experiences.
- Create their own "caterpillars" that will, over the next few days, transform into cocoons, and then into butterflies.
- Demonstrate a basic understanding of the metamorphosis process and describe what happened to the caterpillars and the cocoons, demonstrating a basic understanding of the metamorphosis process.
- Students will measure, observe, and record growing seeds/plants and transplant them to a new home.
- Recall events in the order in which they occurred in the text and illustrate the life cycle of a frog.
- Compare the life cycle of a plant with a frog's life cycle.
- Students will discuss and plan a terrarium design project.
- Students will plan and create a collaborative terrarium project that demonstrates what they have learned about the life cycles of living organisms.
- Communicate to classmates and teachers about the habitat that they have created.

For More Information

Contact Us At

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EbD TEEMS NxtGen – Kindergarten At-A-Glance

Intended Audience: Kindergarten **Course Length: 6-8 weeks**

A Home for All Seasons engages young learners in hands-on inquiry and design as they explore animal homes. The Kindergarten Building Block integrates concepts of science, technology, engineering, and mathematics as students create various animal homes. Science and mathematics concepts that are reinforced include the basic needs of organisms, the environment in which organisms live, numbers and quantities, measurement, and shapes. Following guided inquiry activities, a design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they design and build a birdhouse.

Objectives

- Distinguish between the natural world and the human-made world.
- Categorize objects as either natural or designed by humans.
- Ask questions and make predictions.
- Identify the main topic and retell details of text with prompting.
- Ask and answer questions about details in a text with prompting.
- Ask and answer questions about unknown words with prompting.
- Sort words into categories to gain a sense of the concepts represented by the categories.
- Communicate ideas and solutions through discussion, writing, drawing, and presentation.
- Determine the meaning and use of domain-specific words.
- Know that humans use tools and devices to help them do a variety of things.
- Understand how things are made and how they work.
- List different types of structures and their purposes (animal homes).
- Describe how the use of tools and machines can be helpful or harmful.
- Describe basic needs of plants and animals (e.g., air, water, nutrients, shelter, and light).
- Identify physical characteristics of the environment necessary for animal survival in different environments (e.g., wetland, tundra, desert, forest, ocean).
- Generate questions about objects, organisms, or events that can be answered through scientific investigations.
- Identify and describe objects using names of geometric shapes.
- Draw and build shapes to model geometric shapes in the world.
- Describe how the type of structure determines how the parts are put together (homes of different animals).
- Identify physical characteristics of the environment necessary for animal survival in different environments (e.g., wetland, tundra, desert, forest, ocean).
- Collaboratively write informative text based on a specific topic.
- Describe measurable attributes of objects such as length or weight.
- Identify numbers used to represent quantities.
- Describe measurable attributes of objects such as length or weight.
- Name tools and describe their use.
- Identify appropriate tools or instruments for specific tasks and describe the information they can provide (e.g., Measuring: length – ruler, volume – beaker, temperature – thermometer).
- Recognize that everyone can design solutions to problems.
- Apply a design process that includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others to solve a technological problem.
- Write and draw ideas and solutions during the design process.
- Construct an object using the design process.

For More Information

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EbD TEEMS NxtGen – Grade 1 At-A-Glance

Intended Audience: 1st Grade **Course Length: 6-8 weeks**

Can You Hear Me? engages young learners in hands-on inquiry and design as they explore one of the greatest challenges of the 21st century: how we are able to hear and process sounds. This Building Block integrates concepts of science, technology, engineering, and mathematics through the environmental context of noise pollution. Science and mathematics concepts that are reinforced include the history of the telephone, echolocation, vibrations, and counting beats of a rhythm. By utilizing an experiential approach, students collaboratively investigate the issue of noise pollution, which is probably something they do not realize is a form of pollution. Following guided inquiry activities, a design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they design and create something that makes a sound and also helps them detect sounds. A *Grand Challenge for Engineering* identified by the National Academy of Engineering as "Reverse-Engineer the Brain" serves as a real-world inspiration for students to connect their learning with the present and the future.

Objectives

- Identify tools and techniques that people use to help them complete tasks.
- Name materials used to make things.
- Distinguish between the natural world and the human-made world.
- Identify science as a way of answering questions and explaining the natural world.
- Identify technology as a way of inventing tools and techniques to solve human problems.
- Categorize objects as either natural or designed by humans.
- Describe a product that has been made to meet a specific human need or want.
- Provide an example of how the way people live and work has changed throughout history because of technology.
- Recognize that everyone can design solutions to problems.
- Describe design as a creative process.
- Apply a design process that includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others to solve a technological problem.
- Write and draw ideas and solutions during the design process.
- Construct an object using the design process.
- Identify agricultural technologies that make it possible for food to be available year round and to conserve resources.
- Generate questions about objects, organisms, or events that can be answered through scientific investigations.
- Design, conduct, and/or describe the steps of an investigation to test one variable.
- State a conclusion consistent with information, observations, or data.
- Identify contributions that humans have made throughout the history of science and technology.
- Ask and answer questions about details in a text with prompting.
- Identify the main topic and retell key details of a text.
- Ask and answer questions to determine unknown words.
- Write informative text that includes the topic name, some facts supplied about the topic, and a closure.
- Answer questions on a provided topic following shared research.
- Describe familiar people, places, things, and events with relevant details and express ideas clearly.
- Accurately count beats using a variety of rhythms.

For More Information

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EbD TEEMS NxtGen – Grade 2 At-A-Glance

Intended Audience: 2nd Grade **Course Length: 6-8 weeks**

From Nature to Me engages young learners in hands-on inquiry and design as they explore biomimicry (one of the most important challenges of the 21st century) and learn how we can obtain from nature the tools necessary for scientific discovery. This Building Block integrates concepts of science, technology, engineering, and mathematics through the environmental context of learning about bees and researching why they seem to be disappearing. By utilizing an experiential approach, students collaboratively begin to explore how animals spread seeds and how their environment is then suitable for habitation. Following guided inquiry activities, a design challenge allows students to create a device that will travel on land or air to disperse seeds. Thus, they will be engineering the tools of scientific discovery. This experience serves as a real-world inspiration for students to connect their learning with both the present and the future.

Objectives

- Distinguish between the natural world and the human-made world.
- Identify tools and techniques that people use to help them complete tasks.
- Describe how the use of tools and machines can be helpful or harmful particularly to the environment.
- Describe a product that has been made to meet a specific human need or want.
- Recognize that everyone can design solutions to problems.
- Describe design as a creative process.
- Apply a design process that includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others to solve a technological problem.
- Construct an object using the design process.
- Describe a manufacturing process or system used to produce a specific product in quantity.
- Generate questions about objects, organisms, or events that can be answered through scientific investigations.
- Design, conduct, and/or describe the steps of an investigation to test one variable.
- Identify appropriate tools or instruments for specific tasks and describe information they can provide (e.g., measuring: length – ruler, volume – beaker, temperature – thermometer).
- Categorize or sort objects using physical characteristics of the materials from which they are made.
- Identify earth resources and materials that come from the environment to meet the needs and wants of humans.
- Use physical properties (e.g., shape, size, color, texture, temperature, volume) to describe matter.
- Identify science as a way of answering questions and explaining the natural world.
- Identify technology as a way of inventing tools and techniques to solve human problems.
- Identify resources that come from basic materials (e.g., air, water, soil) and their uses.
- Describe how the effects of new ideas, new ways of doing things, and inventions can be good or bad.
- Identify contributions that humans have made throughout the history of science and technology.
- Create bar graphs to show specific amounts.
- Ask and answer who, what, where, when, and how questions about key details in a text.
- Identify the main topic and the focus of specific paragraphs in a text.
- Write informative text in which a topic is introduced, some facts supplied to develop points, and a conclusion is provided.
- Report on a topic with appropriate facts and relevant, descriptive details while speaking clearly at an understandable pace.
- Recognize that manufactured products are designed.

For More Information

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EbD TEEMS NxtGen – Grade 3 At-A-Glance

Intended Audience: 3rd Grade **Course Length: 6-8 weeks**

Natural Hazards engages young learners in hands-on inquiry and design as they explore natural hazards that occur on the Earth. This Third Grade Building Block in the EbD-TEEMS Integrative-STEM Curricula for PreK-6 integrates concepts of science, technology, engineering, and mathematics through the environmental context of natural hazards. Science and mathematics concepts that are reinforced include multiple hands-on, inquiry-based activities such as creating designs, exploring regions of the Earth, and analyzing weather data as students learn about weather and climate, and the natural hazards that occur around the world. The final design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they develop a design for a snow shoe to help people travel during a blizzard. A Grand Challenge for Engineering, identified by the National Academy of Engineering —Engineer the Tools of Scientific Discovery— serves as a real-world inspiration for students to connect their learning about Natural Hazards and design solutions that reduce the impacts of these hazards.

Objectives

- Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- Compare and contrast the most important points and key details presented in two texts on the same topic.
- Interpret data and graphs in order to describe typical weather conditions expected during particular seasons.
- Reason abstractly and quantitatively about weather and climate and use mathematical models.
- Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories.
- Create a design solution to reduce the impacts of a weather-related hazard by engineering a blizzard shoe design.
- Develop an understanding of the attributes of design and engineering design.
- Read *Wild Weather* by Melvin Berger in order to learn about the different types of weather hazards that happen on the Earth.
- Research a specific natural hazard and create a poster to display information about the hazard as well as possible impact solutions.
- Experiment with different materials to come up with the best combination that will keep a container warm while it is submerged in ice.
- Develop the abilities to apply the design process using appropriate tools strategically.
- Design a structure that will survive the shake table.
- Read about ancient rituals intended to produce rain and create a rain stick as a way to reduce the impact of having a drought by making it rain.
- Investigate using different materials to see how they perform against each other for waterproofing.
- Learn how to set up and use a STEM notebook in order to maximize knowledge of concepts and skills throughout this building block.
- Design a plan for a solution to help reduce the impact of a natural hazard that happens at home.
- Read the story about the life of Sir Francis Beaufort and review the Beaufort Wind Scale and read the Beaufort Wind Scale by answering questions.
- Build a house that will survive the wind of a fan and follow specific criteria for success and constraints on materials.
- Apply learning throughout this Building Block and design a shoe that will reduce the impact of the weather-related hazard while following the design process and meeting the criteria and constraints of the challenge.

For More Information

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EbD TEEMS NxtGen – Grade 4
At-A-Glance

Intended Audience: 4th Grade **Course Length: 6-8 weeks**

The Power of Solar develops students' understanding of energy systems and related technologies, temperature, electricity, and sustainable sources of energy. In this Building Block, scientific inquiry and technological design are purposefully used as learning approaches to develop students' STEM literacy and higher-level thinking skills. Science and mathematics concepts that are reinforced include the solar system, energy transfer, temperature, electricity, decimals, perimeter, area, angles, points, lines, rays, and symmetry. By utilizing an experiential approach, students collaboratively investigate solar energy as a global issue and learn that stewardship and innovation can make a difference in solving the world's problems.

Objectives

- Describe how tools are used to design, make, use, or assess technology.
- Identify science as a way of answering questions and explaining the natural world.
- Identify technology as a way of inventing tools and techniques to solve human problems.
- Identify earth resources and materials that come from the environment to meet the needs and wants of humans.
- Describe an example of common technological change in a community (e.g., transportation, communication) that has had either a positive or negative impact on society or the environment.
- Describe how the results of the use of technology can be good or bad.
- Draw inferences from a text, referring to details and examples in the text as evidence.
- Describe how tools, machines, products, and systems use energy.
- Distinguish between a scientific fact and an opinion, providing clear explanations that connect claims and evidence.
- Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.
- Design, conduct, and/or describe the steps of an investigation to test one variable.
- Identify appropriate tools or instruments for specific tasks and describe information students can provide (Example: measuring = length - ruler, volume - beaker, temperature - thermometer).
- State a conclusion consistent with information, observations, or data.
- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- Illustrate a complete direct current series circuit composed of a power source (battery or solar cell), wire, and bulb (LED or incandescent).
- Identify parts of a system and explain how the system may not work as planned if a part is missing.
- Write clear and coherent informative text in which the development and organization are appropriate to task, purpose, and audience.
- Identify technology as a way of inventing tools and techniques to solve human problems.
- Describe how tools and machines extend human capabilities in science and technology.
- Apply a design process that includes defining a problem, generating ideas, selecting a solution, making an item, evaluating it, and presenting results to solve a technological problem.
- Identify that requirements are the criteria or limits that must be met when designing or making a product.
- Identify specific resources (e.g., tools, materials, information, people, time) necessary to complete specified tasks.
- Apply a design process that includes defining a problem, generating ideas, selecting a solution, making an item, evaluating it, and presenting results to solve a technological problem.

For More Information

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EbD TEEMS NxtGen – Grade 5 At-A-Glance

Intended Audience: 5th Grade **Course Length: 6-8 weeks**

Our Water, Our World engages learners in hands-on inquiry and design as they explore one of the greatest challenges of the 21st century: universal access to clean water. This Building Block integrates concepts of science, technology, engineering, and mathematics through the environmental context of water resource management and conservation. By utilizing an experiential approach, students collaboratively investigate global water issues and learn that stewardship and innovation can make a difference in solving the world's problems.

Objectives

- Identify Earth resources and materials that come from the environment to meet the needs and wants of humans.
- Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
- Identify science as a way of answering questions and explaining the natural world.
- Identify technology as a way of inventing tools and techniques to solve human problems.
- Describe an example of a common technological change in a community (transportation, communication) that has had either a positive or negative impact on society or the environment.
- Distinguish changes in the environment as natural or human-made.
- Compare changes in the environment that are good or bad.
- Describe how the results of the use of technology can be good or bad.
- Identify contributions that humans have made throughout the history of science and technology.
- Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- Distinguish the difference between the different spheres and how they interact with each other.
- Distinguish between a scientific fact and an opinion, providing clear explanations that connect claims and evidence.
- Describe the movement of water on Earth as it circulates through the phases of the water cycle.
- Generate questions about objects, organisms, or events that can be answered through scientific investigations.
- State a conclusion consistent with information, observations, and data.
- Use physical properties (shape, size, color, texture, temperature, volume) to describe matter.
- Provide an example of the effect that human waste has had on the environment (water).
- Determine the main idea of a text and support it with key details.
- Apply knowledge about a topic gained through research to the completion of a specified project.
- Design, conduct, and/or describe the steps of an investigation to test one variable.
- Identify tools, materials, and techniques used to make things or complete tasks.
- Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of a problem.
- Describe the design process as a method of developing solutions to problems.
- Apply a design process that includes defining a problem, generating ideas, selecting a solution, making an item, evaluating it, and presenting results to solve a technological problem.
- Describe how the effects of new ideas, new ways of doing things, and inventions can be good or bad.

EbD TEEMS NxtGen – Grade 6 At-A-Glance

Intended Audience: 6th Grade **Course Length: 6-8 weeks**

Our World and Me serves as a capstone experience for sixth-grade learners using hands-on inquiry and design as they explore robotics through the engineering field of mechatronics. Mechatronics is an interdisciplinary engineering field that focuses on the integration of mechanical, electrical, and software systems. This curriculum extends ITEEA's **EbD-TEEMS Integrative-STEM Curricula for K-6** as the students create an interactive automaton that (1) educates others about environmental impacts caused by humans/technology, OR (2) presents a new idea on how to reduce human/technological impacts on the environment. Following guided inquiry activities, a design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as their automaton moves from a mere mechanical device to a robot. In this course, students learn about robotics, coding, computational thinking and programming fundamentals.

Objectives

- Students will use the brainstorming guidelines to generate ideas.
- Students collaborate as a team to select and share ideas regarding a selected topic. Students will view multiple videos (and other multimedia sources as appropriate) to gather information on the historical and cultural origins of automata and mechanical toys and record their observations in their engineering design notebooks.
- Students will use the practice of reverse-engineering to examine how an object/device works and record their observations in their engineering design notebooks.
- Students will use construction methods such as folding, cutting, gluing, and/or taping to construct a crank mechanism.
- Using the storyboard technique, students will observe how their crank mechanism works and create a five-panel storyboard and demonstration for class members who constructed a different crank mechanism.
- Students will identify and describe the types of motion found in their crank mechanism by using the terms oscillation, rotary, reciprocating, irregular, linear, and intermittent.
- Students will learn how three-dimensional figures are represented using nets made up of rectangles and apply these techniques in the context of solving real-world and mathematical problems.
- Students will use the skill of prototyping to construct a new display stand by either scaling up or scaling down from the original design.
- Students will practice using the Engineering Design Process to understand the Mini-Challenge Design Brief: Electrify!
- Students will read, interpret, and use electronic schematic symbols found in Technical Data Sheets, Standard Operating Procedure documents, and schematic diagrams; as well as schematic symbols used on electrical components (e.g., battery, battery holder) and instruments (e.g., digital multimeter).
- Students will use the digital multimeter (DMM) to perform electrical measurements including battery voltage checks and continuity checks of a designed circuit.
- Students will use Technical Data Sheets (TDS) to gain an understanding of various electrical components and will add information to the TDS based on their use of the components.
- Students will use Standard Operating Procedure documents (SOP) in the use of electrical components, tools, or processes.
- Students will construct schematic diagrams demonstrating the relative speed and the direction of the motor.
- Students will use a multimeter to determine the potentiometer's maximum resistance, left-center range, and right-center range.
- Students will use tools to connect devices to a controller. Students will create expressions and sequences using programming software.
- Students learn coding, computational thinking and programming fundamentals.

For More Information

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