The following materials are included with the Food for Thought STEM Challenge Kit to serve up to six youth. Additional support materials, as well as printable versions of worksheets and a Spanish version of the facilitator guide, are available for download at: 4-H.org/programs/stem-challenge

- 1 - Food for Thought storage bag
- 1 - Facilitator Guidebook
- 1 - Food Fighters Board Game
  - Includes game board, instruction sheet, deck of cards (120), food tokens (60), pawns (6)
- 1 - Set of Regional Food Challenge Cards (8)
- 6 - Chew on This Design Worksheets
- 1 - Food System Fact Sheet
- 26 - Food cards
- 6 - Know to Grow Design Sheets (2 each of three designs)
- 12 - Wooden Sticks
- 12 - Sheets of cellophane
- 12 - Plant Starter Pouches
- 3 - Career Posters

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INTRODUCTION

4-H is the largest youth development organization in the United States, serving nearly six million youth each year. Our philosophy is to provide young people with fun and engaging educational experiences that give them an opportunity to learn and develop important life skills including decision making, communication and perseverance. Our goal is to help youth thrive by providing programs that allow them the opportunity to find their spark—igniting a passion to learn about and stay engaged with STEM. Learn more at 4-H.org.

For 2024, National 4-H Council partnered with LSU AgCenter, North Dakota State University, Penn State Extension and the University of Nebraska–Lincoln Extension to create the Food for Thought STEM Challenge Kit. With STEM-based activities that are fun, engaging and accessible to young people everywhere, the activities allow youth to develop observational and problem-solving skills while they make discoveries and develop confidence in STEM subjects.

Food for Thought is ideal for youth ages 8–14 years to spark an interest in STEM and inspire real-world actions. This year’s theme of food security will provide youth with the fundamental knowledge of factors that contribute to food security, how people are impacted globally and locally and how youth can personally contribute to creating a more food secure community.

This guide contains everything for facilitating three food security related activities: Food Fighters, Chew on This and Know to Grow. No prior experience with STEM is needed to help young people with the activities. Activities have been designed with simplicity and adaptability in mind so that anyone – from teachers to teen leaders to parents – can facilitate them. There is a logical progression to the activities presented in the challenge, but each activity can be conducted independently or in any order. Each activity includes a set of opening and closing reflective questions to enhance the learning and fun of the experience.

Youth can access and enjoy the 4-H STEM Challenge year round. With help, we can spark an interest in STEM for all youth, making hands-on learning accessible to everyone!

Preparation: Get ready to facilitate Food for Thought activities by reading through this guide. Focus on the Facilitator Preparation section starting on page 5 for a concise overview of how to lead youth through the kit activities.

Plan: We encourage educators and facilitators to plan challenge events year-round. An event can be as simple as sharing an activity as an after-school lesson, teaching a few youth at home or hosting a larger community event. Re-use or purchase additional kits to bring the STEM challenge to more youth.

Check-in: Visit 4-H.org/programs/stem-challenge for the latest updates! This webpage is the resource to help make the most of the 4-H STEM Challenge, including promotional materials, printable resources and webinars for adults and teens.

Share: Tell your friends and colleagues about the 4-H STEM Challenge and share on social media using #4HSTEMChallenge. Feedback helps us improve the 4-H STEM Challenge each year.
Facilitator Preparation

This section provides the background needed to comfortably present and teach the STEM topics covered in this year’s Food for Thought 4-H STEM Challenge Kit. Let’s get started!

Facilitator Checklist

- Visit 4-H.org/programs/stem-challenge for information, webinars and training videos for this year’s challenge.
- Select kit activities that best fit your group, time and space.
- Review the vocabulary, materials and full instructions for each of the activities you choose.
- Gather the supplies needed to complete the activities.

Skills Inventory

STEM learning skills are the skills youth need to be successful when they explore and engage in science, math and engineering experiences and activities. These learning skills also align with important life skills that are taught within 4-H. Key STEM skills the Food for Thought activities help youth to develop include:

**Creativity:** The act of using imagination to bring original ideas to life. Applying creative approaches to STEM-based challenges helps youth express thoughts and feelings, improve problem solving skills and be open minded to unlimited possibilities.

**Critical Thinking:** Analyzing, evaluating, reflecting and processing information to propose solutions to solve problems. This process helps youth develop into independent, critical thinkers.

**Collaboration:** Teamwork and working together in groups. Collaboration teaches youth how to identify strengths of team members and how to work together to efficiently complete a task.

**Decision Making:** Choosing between possible solutions to a problem. Making decisions helps youth investigate their ideas, develop critical thinking and learn how to compromise with others.

Engineering Design Process: Using a cycle of asking questions, imagining solutions, formulating a plan, creating and improving design ideas to solve a problem. Through each step, youth get closer to finding a solution to the problem, while using STEM skills in the process.

Inquiry Skills: Solving problems by asking questions, proposing ideas and testing solutions. This puts youth in the driver’s seat to their own learning.

**Problem Solving:** Creating and finding solutions to effectively solve a problem. This requires youth to use the information they have and apply a problem-solving process (such as the Engineering Design Process) to reach a solution.

**Real-World Application:** Youth learn and develop skills, then apply these to solve real-world problems. This helps youth connect STEM-based learning skills to real life scenarios, careers and workplace applications.

Planning Delivery

Food for Thought is adaptable to a wide range of space, time and technology constraints. Each of the three activities are “unplugged” and do not require technology or equipment to deliver them. Food Fighters, Chew on This and Know to Grow contain knowledge that builds from one activity to another, but can be enjoyed separately and in any sequence to fit any out-of-school learning environment, classroom or family time.

Facilitation Tips

Encourage thinking, sharing and making connections during these activities. A great strategy to do this is to use the K-W-L (Know-Want-Learned) approach. To introduce new topics, anchor youth in their current knowledge, stimulate thought and track learning, focus questions around what youth know, what they want to learn and what they have learned. Ask K-W-L questions directly to youth, have them write answers down independently or create a graffiti wall with a designated spot for each question. Each activity has getting started and reflection K-W-L questions available to direct discussion.
Work together with your community to help build food security for the town of Cloverton! Journey together through the food supply chain and make decisions that will secure food moving from farm to fork!

Food Fighters is a board game where youth work together earning food tokens to establish food security for their town, Cloverton. The game takes them through six parts of the food supply chain: growers, transportation, processing, retail, consumer and regulations. Throughout the game, kids draw cards introducing scenarios, giving them an action to perform which could either help or hurt their food security.

**Activity time:**
60 minutes
- Intro: 5 minutes
- Activity: 30–45 minutes
- Reflection: 10 minutes
Rise to the challenge of meeting a food security need by using entrepreneurial design thinking! Brainstorm ways to reduce or repurpose waste, cut costs or create new or more efficient distribution in different parts of the food system to increase access to nutritious and affordable foods.

Chew on This is an entrepreneurial design challenge where youth examine waste from food production and processing and find a meaningful way to use the waste to contribute to establishing food security. Youth are given the steps and tools to imagine products and solutions that have a basis in real-world scenarios related to regional food production in the United States. This allows youth to learn about the challenges in food production, as well as problem solving solutions to minimize barriers and hardships people face in accessing food.

Activity time:
60 minutes
• Intro: 5-10 minutes
• Activity: 45 minutes
• Reflection: 5-10 minutes

Additional Materials Not Included:
• Dry-erase markers
• Poster board
• Markers/colored pencils
• Paper

Food security is a global issue, but people can create and contribute to solutions in their own home! Youth work through the engineering design process to learn about greenhouses and growing the plants we eat to provide nutritious food.

Know to Grow is an engineering design challenge where youth learn about plants we eat and build a safe place for them to grow—no matter the environment. Many people around the world must use greenhouses to produce food due to the climate in their community. In this activity, youth identify the parts of a plant that they can use to grow new plants from scraps of food they have at home, and work to build a greenhouse to meet the needs of a specific extreme environment. Youth use the engineering design process to plan and ultimately build a model of a working greenhouse.

Activity time:
60–90 minutes
• Part 1: 10–15 minutes
• Part 2: 45–60 minutes
• Reflection: 5–10 minutes

Additional Materials Not Included:
• Seeds - recommended seeds: beans, peas, corn, local vegetables. Need one seed per greenhouse.
• Soil - recommended potting soil or peat pellets
• Assorted recyclable materials including cardboard, small yogurt containers, plastic water bottles, take-out food containers, plastic baggies, egg cartons, toilet paper rolls, etc.
• Masking tape or duct tape
• Scissors
• Dry-erase markers
• Paper
• Markers or other decorating items
• A small fan
• Ruler or measuring tape
The community of Cloverton needs help! Youth work together as a team to make fresh, healthy food easily and reliably available to the citizens of Cloverton.

**Goals, Objectives and Outcomes**

By the end of the activity, youth will be able to:

- Describe the elements that contribute to food security.
- Identify steps in the food supply chain to get food from its source to consumers.
- Identify actions that they and their communities can take to increase food security.

**Activity Time (60 minutes)**

- Intro: 5 minutes
- Activity: 30 - 45 minutes
- Reflection: 10 minutes

**Materials**

- 1 - Game Board
- 1 - Instruction Sheet
- 60 - Food Tokens
- 6 - Player Pawns
- 120 - Action Cards
  - 20 - Grower Cards
  - 20 - Transportation Cards
  - 20 - Processing Cards
  - 20 - Retail Cards
  - 20 - Consumer Cards
  - 20 - Regulation Cards

**Important Vocabulary**

**Food Insecure** - Not having reliable access to food to meet one’s basic needs.

**Food Security** - Having reliable access to a sufficient quantity of affordable, nutritious food to meet one’s basic needs.

**Food Supply Chain** - The people and processes involved to get food from where it is grown to where/when people eat it.
Activity Guidelines

Energizer/Warm-up

To get started, ask some questions:

1. What does the word security mean to you?
2. Have you heard the term Food Security?
3. What do you think the term Food Security means?

Food Security means people have reliable access to enough affordable, nutritious food that meets daily needs. Communities and people experience food security in different ways. The United States Department of Agriculture (USDA) defined levels of food security in the following ranges:

- **High Food Security:** People have all the food they need to meet their needs. It’s available, affordable and healthy.
- **Medium Food Security:** People have worries that their food supply will run out before they are able to buy more.
- **Low Food Security:** People can only eat what food is available. The variety of food is limited and the quality of the food may be poor (lack of nutrition, expired, etc). A household at this level is also referred to as food insecure.
- **Very Low Food Security:** People cannot regularly access food. They only eat when food is available or when they can afford it, which results in needs not being met. A household at this level is also referred to as food insecure.

There are a variety of factors that affect food security:

- **Availability:** There is enough food available to eat.
- **Access:** People can get to the food that is available.
- **Utilization:** Quality food provides the body with the energy and nutrients it needs.
- **Stability:** Having availability and access to nutritious food over time.

In order to get all people to a High Food Security level, we need to make sure there is a strong food supply chain. A food supply chain is the people and processes involved to get food from anywhere it is grown to where and when people eat it.

There are six main parts of the food supply chain that each play their own unique role in contributing to food security:

- **Growers:** The people that produce raw materials that we either consume or process into other foods. Examples: Someone who catches fish or a farmer who grows crops like asparagus or squash, etc.
- **Transportation:** Involves moving food from one place to another. Example: A truck driver drives heads of lettuce to the grocery store.
- **Processing:** Turning basic ingredients into food products. Example: Wheat is ground into flour to make the crust for a pizza.
- **Retail:** Places people can access food from growers or processors. Example: Farmer’s markets, restaurants, food pantry, etc.
- **Consumers:** The people who eat the food.
- **Regulation:** Rules put in place by the government to keep the food supply safe. Example: The health department inspects restaurants and stores.

Food Fighters Rules and Information

Youth will play a cooperative board game that takes them through the food supply chain. Youth play as the citizens of a fictional town, Cloverton. Moving around the board by drawing cards, players encounter situations that teach them about problems people face in accessing food.

During gameplay, players earn Food Tokens representing different levels of food security. The goal is for each player to end the game with five Food Tokens and have as many Food Tokens as possible in the community food bank.

For rules and how to play the game, see the instruction sheet included in the Food Fighters board game, or available for download at 4-H.org/programs/stem-challenge

Have one youth serve as the banker that controls the bank of chips to the side of the board.

Reflection

Guide youth through a discussion to reflect and make meaning of their experience:

- What was your community’s ending level of food security?
- What were some of the challenges you faced in the game that made it difficult to be a food secure community?
- Would you do anything differently if you were to play again?
- What is something new you learned in this activity?
- What can you do to help build food security for your home or community?

More to Explore

Once youth have played the game, see how well they do and what level of food security they achieve. Have them replay the game and work towards a higher level of food security.

Educational Standards - NGSS

See page 19 for full definitions of the standards and DCIs.

- **ESS2.E:** Biogeology
- **ESS3.A:** Natural Resources
- **ESS3.B:** Natural Hazards
- **ESS3.C:** Human Impacts on Earth Systems
- **LS1.B:** Growth and Development of Organisms
- **LS2.A:** Interdependent Relationships in Ecosystems
- **LS2.C:** Ecosystem Dynamics, Functioning and Resilience
- **LS2.D:** Social Interactions and Group Behavior
Rise to the challenge of meeting a food security need by using entrepreneurial design thinking! Brainstorm ways to reduce or repurpose waste, cut costs, or create new or more efficient distribution in various sectors of the food system to increase access to nutritious and affordable foods.

**Goals, Objectives and Outcomes**

By the end of the activity, youth will be able to:

- Apply the Entrepreneurial Design Process to brainstorm solutions to address a problem.
- Develop an entrepreneurial pitch to communicate their solutions and ideas.
- Identify actions that they and their communities can take to increase food security.

**Activity Time (60 minutes)**

- Warm-up: 5-10 minutes
- Activity: 45 minutes
- Reflection: 5-10 minutes

**Materials**

**Materials Included in the Kit**

- 1 – Food System Fact Sheet Poster
- 8 – Regional Scenario Cards
- 6 – Design Worksheets

**Materials Not Included in the Kit**

- Dry-erase markers
- Poster board
- Markers/colored pencils
- Blank paper

**Important Vocabulary**

**Hunger** – A condition in which people do not get enough food to provide the nutrients (carbohydrates, fats, proteins, vitamins, minerals and water) for fully productive, active lives.

**Food Security** – Having reliable access to a sufficient quantity of affordable, nutritious food to meet one’s basic needs.

**Unequal Distribution** – A system or situation that is unfair because it gives more power or privileges to one person or group of people than to others.

**Entrepreneur** – A person who starts a business with the intention of solving problems by providing a service or product.

**Pitch** – A presentation where entrepreneurs present their ideas and explain how it fills a need.

**Target Market/Customer Base** – A specific group of potential customers who a business aims to reach with its products or services.
Activity Guidelines

Energizer/Warm-up

To get started, ask some questions:

1. What does the term food security mean to you?
2. With your understanding of food security and what you learned about the food system from the Food Fighters game, what do you think are some of the reasons people face hunger?

Hunger is when people and communities have low food security, meaning they are not able to reliably access nutritious food on a regular basis. The two main factors contributing to low food security are the large gap between rich and poor, and an unequal distribution of food.

As youth experienced in Food Fighters, there are many places where people face challenges in accessing nutritious food. Sometimes people simply don’t have the money to purchase food, or the food is too expensive. Other times, the food is not easily accessible and people have trouble physically getting food.

Pose the following questions to the group:

1. What is an entrepreneur or inventor?
   - Inventors create new products or solutions.
   - Entrepreneurs create businesses and companies around new ideas and products.
2. Who are some well-known inventors or entrepreneurs?
   - Alexander Graham Bell – Telephone
   - George Washington Carver – Peanut products, methods to prevent soil erosion
   - Steve Jobs – Apple Computers/iPhone
   - Thomas Edison – Lightbulb, phonograph, movie camera
   - Mark Cuban – Software companies
   - Oprah Winfrey – Media company
   - Martha Stewart – Cooking media company
3. How do you think inventors get their ideas?

After the discussion, use the suggested script below to introduce the activity:

“How many of you like tater tots? Did you know that tater tots were invented as a way to use potato scraps leftover from making french fries? These scraps were used as livestock feed until entrepreneurs figured out that by adding some flour and seasonings to the chopped up scraps that they could then make a new tasty product that people would eat. YOU are going to be entrepreneurs today to help solve food security issues.”

Procedure Overview

Youth will work in small groups to come up with ways to meet a food security need by using the entrepreneurial design process. Groups will brainstorm ways to reduce or repurpose waste, cut costs, or create new or more efficient distribution in various sectors of the food system to increase access to nutritious and affordable foods.

Split youth into groups of two or three. Explain that their challenge is to cooperatively develop a solution that will positively impact food distribution by:

- Reducing waste/cost
- Repurposing common waste
- Creating new or more efficient distribution in various sectors

Discuss the Entrepreneurial Design Process

What is Design Thinking?
Design Thinking is a way for people to design solutions for end users with a single problem statement in mind. Introduce design thinking by briefly walking youth through each step.

- **Empathize** – To try to understand the feelings, thoughts and experiences of others. In the Entrepreneurial Design Process, this allows entrepreneurs to put themselves in their customers’ shoes and understand their needs.
  
  *Example:* Retail stores don't know what to do with excess packaging that comes with produce.

- **Define** – To identify the exact problem or issue. Using known facts and questions identified through the empathize step, what is the specific problem that needs addressing?
  
  *Example:* Retail stores need a way to dispose of (or reuse) packaging material after they stock produce into the refrigerated display.

- **Ideate** – To intentionally form an idea. Brainstorming and thinking of anything that comes to mind that might be a solution. No idea is a bad idea in this step.
  
  *Example:* Design packaging that doubles as a display; develop compostable packaging; use reusable packaging that can be shipped back to the supplier.

- **Prototype** – The first or preliminary model of a new design or construction. This is a very basic model of the idea without having to be fully functional.
  
  *Example:* Make a model to show how packaging can be used for both shipping and display, sketch out a solution for returning reusable crates.

- **Test** – To evaluate and uncover problems or shortcomings. Try out the prototype to find successes and limitations which can be fixed and improved to make a better final product through several rounds of testing.
  
  *Example:* Do a trial run of shipping and displaying produce using the prototype. Make note of issues and changes to make and implement the changes. Repeat the test until satisfied with the finished product.

This activity only goes through the empathize, define and ideate steps of the process, but if youth are passionate about their idea, encourage them to pursue building a prototype and testing their ideas. Who knows, they may be the next great entrepreneur!
Design Thinking Process

Provide each youth with a worksheet and dry erase marker. Have each group randomly select one of the regional scenario cards. Allow the groups to read their scenario cards and review contents of the resource poster. These cards identify a challenge within the food system that is unique to a certain region of the United States.

**Step 1: Empathize & Define (5-10 minutes)**

Allow time to work through the first part of the worksheet where youth identify the challenge and brainstorm ways to address their group’s regional scenario.

**Empathize**
- Encourage youth to put themselves in food system contributors’ shoes after reading their team scenario and ask them to think about what may be most impactful or helpful.
- Who is their **target market**? Who are the customers that have an issue to address? Who would benefit from a potential solution?

**Define**
- Encourage youth to review the food system fact sheet poster and gather all the insights available — food system contributor needs and barriers, lifestyle realities and cultural influences — to begin to make sense of solutions they are exploring.
- What themes or patterns are bubbling to the surface? Are they asking the right questions and do they need to reassess assumptions about the task at hand?
- Once the challenge is clear, the team can move into the ideation phase with confidence and inspiration.

**Step 2: Ideate (5-10 minutes)**

Allow youth to brainstorm individually and come up with 3 to 5 ideas that they can share with their team members.
- Encourage them to refer to the questions on their worksheet as they ideate. It will be important for them to communicate these pieces to their team members to show the value of their idea.
- They may list things they know currently exist, but encourage them to be as imaginative as possible. Jot down all ideas. No ideas are bad ideas! After creating a list, combine similar ideas and make sure that everyone understands each one.

**Step 3: Identifying a Prototype (5 minutes)**

Have the groups share ideas and select one for the group to present as their entrepreneurial pitch. Encourage groups to pick the one that would be most innovative and has the greatest impact on food security.

If groups are having trouble deciding on one idea, consider having them vote, or see if any ideas can be combined.
Step 4: Create your Pitch! (15–20 minutes)

On the back of the worksheet, designate a product designer to sketch group ideas of what the product could look like.

After the allotted work time, each group will have a few minutes to present their pitch. Encourage youth to go through all of the quick pitch items on the back of the worksheet to prepare for their pitch.

Have youth create a promotional poster for their new product using poster board and markers or other design materials, highlighting all of the items they worked through on the worksheet.

Encourage youth to include the following:

- A sketch of the design
- The name of their product/idea
- Outline the uses and functions
- Be sure to answer these questions:
  - What problem does it solve?
  - How is it unique?

Presentation: (15–20 minutes)

Allow each team 2–3 minutes to present their pitch. If time allows, encourage other groups to ask questions or have a few set questions to ask each group.

Reflection

Guide youth through a discussion to reflect and make meaning of their experience:

- What was something you learned about product creation and product pitches?
- What was the most challenging part of coming up with an idea?
- How would you prototype and test your product if you had more time?
- What resources or people would you need to collaborate with to make your product solution successful?
- How do inventions and new ideas contribute to establishing food security?

More to Explore

- Have youth research further and build a prototype of their idea.
- Have groups brainstorm other scenarios that might help contribute to food waste and explore solutions.
- Use the Food Fighters cards as sources for potential scenarios and challenges to address.

Educational Standards & Science and Engineering Practices (NGSS)

See page 19 for full definitions of the standards and DCIs.

- 4-ESS3-2: Earth and Human Activity
- 3–5-ETS1-1: Engineering Design
- 3–5-ETS1-2: Engineering Design
- ESS3.A: Natural Resources
- ESS3.C: Human Impacts on Earth Systems
- K-ESS2-2: Earth’s Systems
- LS2.D: Social Interactions and Group Behavior
- MS–ETS1–1: Engineering Design
Food security is a global issue, but people can create and contribute to solutions in their own home! Youth work through the engineering design process to learn about greenhouses and growing the plants we eat to provide nutritious food.

**Goals, Objectives and Outcomes**

By the end of the activity, youth will be able to:

- List the benefits of using a greenhouse in a specific environment.
- Understand how engineering is involved in designing and building a greenhouse.
- Identify actions that they and their communities can take to increase food security.

**Activity Time (60-90 minutes)**

- Part 1: 10–15 minutes
- Part 2: 45–60 minutes
- Reflection: 5–10 minutes

**Materials**

*Materials Included in the Kit*

- 6 – Design Sheets (2 cold, 2 hot, 2 urban)
- 26 – Food Cards
- 12 – Seed Starting Pouches
- 12 – Sheets of cellophane
- 12 – Wooden Sticks

*Materials Not Included in the Kit*

- Seeds – Recommended: beans, peas, corn, local vegetables. Need one seed per greenhouse.
- Soil – recommended potting soil or peat pellets
- Assorted recyclable materials, including cardboard, small yogurt containers, plastic water bottles, take-out food containers, plastic baggies, egg cartons, toilet paper rolls, etc.
- Masking tape or duct tape
- Scissors
- Dry-erase markers
- Paper
- Markers or other decorating items
- Small fan
- Ruler or measuring tape

**Important Vocabulary**

- **Engineer** – A person who uses scientific knowledge and training to design, build or operate engines, machines, systems or structures.
- **Engineering Design Process** – A series of steps that engineers use to create solutions to a problem or challenge.
- **Food Security** – Having reliable access to a sufficient quantity of affordable, nutritious food to meet a person’s basic needs.
- **Greenhouse** – A building, room or structure made of a transparent material (usually glass) used to grow plants in a controlled environment.
- **Photosynthesis** – The process where plants absorb energy from sunlight to make their own food.
- **Seedling** – A small, young plant that has recently sprouted from a seed.
Activity Guidelines

PART 1: WHAT PART OF THE PLANT DO WE EAT?

Energizer/Warm-up

In this warm-up activity youth will learn about plants and the parts of plants people eat. Youth will categorize common food items by what part of a plant they come from.

To get started, ask some questions:

1. What are your favorite fruits and vegetables to eat?
2. Do you know how your favorite fruit or vegetable is grown? Does it grow in the soil, above the ground or on a tree?

Use the diagram below to go over the parts of a plant:

- **Roots** take water and nutrients from the soil to make the plant healthy and strong. Roots also help hold plants in place so they don’t blow over.
- **Stems** transport water, nutrients and food to the entire plant. They also work with the roots to help support the whole plant.
- **Leaves** absorb sunlight and turn it into stored energy for the plant. This process is called **photosynthesis**, which is what makes leaves green!
- **Flowers** turn into fruit which produce the seeds that grow into new plants.
- **Fruit** holds and protects the seeds of the plant.
- **Seeds** are small capsules that when planted, grow into a new plant (also called a **seedling**).

While all plants have the same basic parts, the fruits and vegetables we eat come from different parts of a plant.
Activity Instructions

To learn more about how plants are used as food, youth will explore different foods and categorize them by what part of a plant they are.

- Using the food cards, pull out the six labeled plant part cards. Place these six cards on a table or the floor.
- Organize youth into pairs or small groups.
- Divide the food cards among the teams, making sure each team receives a variety of plant parts.
- Each team should work together to identify the plant part for each card they have.
- Allow groups to work for a few minutes and be ready to discuss their choices with the group.
- Have teams share their foods and what part of the plant they think it is.
- Go over the correct answers with the youth
  - **Roots:** Carrots, Radish, Beets
  - **Leaves:** Lettuce, Cabbage, Spinach
  - **Fruits:** Tomato, Orange, Apple, Pumpkin, Avocado, Pepper
  - **Stems:** Potato, Asparagus, Celery
  - **Seeds:** Corn, Peas, Pumpkin
  - **Flowers:** Broccoli, Cauliflower, Artichoke

Reflection

Ask the youth the following questions and allow time for discussion:

1. How did you decide which foods went into which categories?
2. Which foods were easiest to identify? Why?
3. Which were the most challenging? Why?
4. Did any of the answers surprise you?
5. Knowing what parts of a plant we can eat, how do we make new plants?
PART 2: GREENHOUSE BUILD

Energizer/Warm-up

Food security relies on availability and access to nutritious foods. In this activity, youth will design a greenhouse to provide shelter to growing plants.

Introduce the activity using the following questions:
1. How does growing fruit and vegetables contribute to food security?
2. What are some places where fruits and vegetables are grown?
3. What is a greenhouse and what is it used for?

A greenhouse is a structure made entirely of a transparent material, such as glass or plastic. The transparent material lets heat in, holds it and is absorbed by the plants inside. Greenhouses allow control over the interior environment, allowing gardening in many different climates.

Growing food can be done at home, in various climates and with limited space—a backyard or even a windowsill. Seeds and scraps from leftover fruits and vegetables can be used to grow new, fresh food for use in your own home.

Activity Instructions

Using the materials provided in the kit and any additional materials you supply, youth will design a model greenhouse to meet the parameters for one of the following environments:
• Very Cold and Snowy - must withstand snow
• Very Hot and Dry - must withstand wind
• Urban: indoor, rooftop or small deck - must have a small footprint

Have youth work in small groups or as individuals – they are engineers tasked with building a model greenhouse for a community in a unique environment. Have each group decide which environment they want to build for from the three options above. Provide each group with a design sheet for their specific environment.

Greenhouse Construction

Allow 30 minutes for building. Youth should use the steps of the Engineering Design Process to design their greenhouse. The Engineering Design Process doesn’t just teach youth how to build a greenhouse, it teaches them how to solve problems.

In the real world, engineers use this process to solve problems and create new and improved ways to do things. While engineers do their work, they deal with a variety of limitations including: the time they have to complete their tasks, the supplies and funding available and the knowledge they have about the current problem they are trying to solve.

• Ask – Identify the problem, the requirements that must be met and the constraints that must be considered.
• Imagine – Brainstorm solutions and research ideas, including what others have done.
• Plan – Choose two or three of the best ideas from the brainstormed list and sketch possible designs, ultimately choosing a single design to build.
• Create – Build a working model that aligns with the design requirements and lies within the design constraints.
• Test – Evaluate the model through testing, collecting and analyzing data, and summarizing the strengths and weaknesses of the design that were revealed during testing.
• Improve – Based on the results of the tests, make improvements on the design, identify changes to make and justify the revisions.

If needed, make copies of the design sheets for each youth. Provide recycled supplies such as cardboard, egg cartons and water bottles to use as additional building materials.
Share and Test

Once finished, have each group share their greenhouse with the entire group. Encourage youth to explain their design, the environment they chose and how they overcame challenges. During the sharing phase, test the greenhouse based on the chosen environment.

Suggested materials for testing each environment:
- **Cold** - Use improvised materials to simulate the weight of snow e.g. ping pong balls, paper, balled up socks.
- **Hot** - Use a fan to simulate wind.
- **Urban** - Use a ruler or measuring tape to measure the dimensions.

After each group has presented their greenhouse, conclude the activity by asking the following questions:

1. What challenges did you face as you built your greenhouse to fit the environment that you chose?
2. What changes did you make, or what changes could you make for your greenhouse to fit the parameters better?
3. Do you think you can use your greenhouse in your own home? Would you have to make any modifications?

Reflection

Guide youth through a discussion to reflect and make meaning of their experience:

1. What are some things you could do at home to produce food?
2. Knowing what parts of plants we eat, what are some things engineers have to consider when building a greenhouse?
3. What could you share with others about the benefits of greenhouse growing?
4. How does growing your own food contribute to food security?

Educational Standards & Science and Engineering Practices (NGSS)

See page 19 for full definitions of the standards and DCIs.

- 3-5-ETS1-1: Engineering Design
- 3-5-ETS1-2: Engineering Design
- ESS3.C: Human Impacts on Earth Systems
- K-ESS2-2: Earth’s Systems
- LS1.B: Growth and Development of Organisms
- LS2.A: Interdependent Relationships in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning and Resilience
- LS2.D: Social Interactions and Group Behavior
- LS4.C: Adaptation
- MS-ETS1-1: Engineering Design

More to Explore

- Have groups challenge themselves using only the materials provided.
- Challenge youth to incorporate a new material into their design.
- Encourage youth to research growing food from scraps at home and build a greenhouse to start a plant.
Educational Standards

The 4-H STEM Challenge kit has historically identified educational standards to help educators evaluate the activities to assess how to incorporate them into lessons and instruction. The Food for Thought STEM Challenge Kit addresses food security through the lens of STEM education. Many of the takeaways from this kit tie to multiple standards rather than just one specific performance expectation. Using both the Next Generation Science Standards (NGSS) performance expectations as well as the identified Disciplinary Core Ideas (DCI) help provide a deeper understanding of concepts. Youth can grasp why the issues are important to address and see a bigger picture of skills put into practice. The concepts below are both performance expectations and Disciplinary Core Ideas identified by the Next Generation Science Standards.

The chart below provides an overview of the NGSS performance expectations and DCI concepts this kit covers. For the complete standards and more information, visit [nextgenscience.org](http://nextgenscience.org).

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<th>Chew on This</th>
<th>Know to Grow</th>
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<td>4-ESS3-2: Earth and Human Activity</td>
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<tr>
<td>K-ESS2-2: Earth's Systems</td>
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<td>MS-ETS1-1: Engineering Design</td>
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<th>NGSS Disciplinary Core Ideas (DCI's)</th>
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<td>LS4.C: Adaptation (3-LS4-3)</td>
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In 4-H, we believe in the power of young people. We see that every child has valuable strengths and real influence to improve the world around us. We are America’s largest youth development organization—empowering nearly six million young people across the U.S. with the skills to lead for a lifetime.

Learn more online at 4-H.org/programs/stem-challenge