



Farm to Table and

We walk into a grocery store and take for granted that we will see products such as canned tomatoes, frozen strawberries, corn flakes, and yogurt. Most of us can easily imagine a tomato, strawberry, corn plant, or a cow on a farm. But, it is more difficult to clearly conceptualize the rest of the steps it takes to go from plants or animals on the farm to the processed and packaged products on store shelves. Where does our food get processed? Who is in charge? What are the steps involved in the system that gets food from the farm to the store? How would your students respond if you asked them to diagram the food system depicting the farm-to-store journey for one food product? Here is a glimpse of the conversation a group of sixth graders had as they diagrammed the story of frozen broccoli (see Figure 1 on page 38).

Sarah: It says here that the broccoli was frozen within 24 hours of harvest to maintain freshness. That doesn't leave much time to get the broccoli frozen; maybe the farmer freezes it right at the farm.

Nisha: I don't think the farmer has the space or equipment to freeze the broccoli. I think a truck comes to the farm to get the fresh broccoli and bring it to a factory.

Tim: I will draw a truck right here by the broccoli plant on the farm, and draw some lines out the back to indicate that this happens very quickly.

Nisha: That sounds good. Let's think through what happens in the factory. When we get frozen broccoli at home it is usually cut up into pieces. I think in the factory the broccoli gets washed

really well, then gets cut up into pieces, then goes into the freezer.

Tim: Do you want me to draw the factory kind of like an assembly line showing where the broccoli gets cleaned, cut, and frozen?

Sarah: Yes. We will show all the steps that happen in the factory. After it is frozen, I think the next step is to put it into plastic bags.

Nisha: Yes, and then a whole bunch of the plastic bags get put into boxes. This all must happen in a big freezer because the broccoli would have to stay frozen. We need to show a big freezer in our diagram.

Through diagramming, students begin to build the understanding that our food system has a series of interacting parts and that each part depends on the other parts. It also helps them think about the environmental impacts of the system. This food-system diagramming activity was part of students' experiences in the Farm to Table and Beyond module of the Linking Food and the Environment (LiFE) Curriculum Series (see Resources).

Farm to Table and Beyond

In Farm to Table and Beyond, students investigate the highly technological, complex system that moves food from the farm to the table. To learn about the food system, students are challenged to think deeply about food. What happens to fruit and vegetables once they are harvested? How do we use technology to help prolong the shelf life of foods? What are the trade-offs? What is involved in transporting food from field



Beyond

Helping Students Make Sense of the Global Food System

by Pamela Koch, Angela Calabrese Barton, Isobel Contento, and Margo Crabtree

to market? Is there an impact on the environment? As students participate in activities to understand the processing, packaging, and transportation subsystems of our larger food system, they begin to make connections between natural systems and human-designed systems.

When we began developing lessons about the food system, little was known about how children think about food in relation to the technological and social food systems (i.e., how food is grown, processed, marketed, and consumed) and the impact of the food system on the environment. Although most students can allude to the idea that food gets transformed in a “factory” between the farm and the store, their descriptions in most cases are quite generalized and somewhat tentative, such as “the potato goes to a factory” or “the farmers turn the potatoes into potato chips” or “the grains get mixed into cereal.”

We believe that a greater awareness of the importance of teaching about food in science education in ways that link food with its impact on both the body and the continued sustainability of the natural environment is critical. After all, the continued sustainability of the ecosystems on which humans depend is being jeopardized by the rapid rate of change of human population, energy use, and resource use along with polarization in consumption of global resources by rich and poor nations, technology, and pollution, which also contribute to social, political, and economic instabilities (AAAS 1989; Orr 1992; Smith 1992). In particular, there is concern that the food supply is in jeopardy as the world uses increasingly unsustainable food production, marketing, and consumption practices (Gussow 1991, 2006; Pimentel, Herdendorf, and Eisenfeld 1994). Although considered “efficient,” these practices are extremely

energy intensive and can have serious negative impacts on the environment, both social and natural (Pimentel, Herdendorf, and Eisenfeld 1994).

Therefore, it is not enough for students to acquire knowledge about how food is produced and processed, they must also come to understand the biological and environmental contexts in which food production, processing, and transportation take place. They need to recognize that such practices use resources such as energy and materials, and that “products, processes, technologies, and inventions in society can result in pollution and environmental degradation and can involve some level of risk to human health or the survival of other species” (NRC 1996). Science education can help children ask questions and develop understandings about issues related to food production, the environment, and waste and pollution, and thus enhance their literacy in science, environmental issues, and nutrition.

Building understandings

“Look at this tomato, it has white stuff growing all around where the stem attaches.”

“Our strawberry is now all black and looks bumpy where the skin looked just a little dark and damaged a few days ago.”

These student observations are part of students’ ongoing investigation exploring what happens to fresh fruit when it is left at room temperature for a period of time. To do this investigation, have students make thorough observations of the physical characteristics, such as size, color, and general condition of fresh tomatoes, strawberries, and grapes. Be sure their observations include

FIGURE 1 Creating a farm-to-store food-system diagram

In this activity, students create diagrams that depict all the steps that happen to a food from the time it leaves the farm until it arrives at the store. This activity works well with foods that have one basic ingredient, such as peanut butter, bread, cheese, pickles, jelly, frozen green beans, canned kidney beans, or meatballs. If students are interested in a food such as a cheeseburger or a slice of pizza, assign groups to different parts of these foods. For example, you may have several groups work on cheeseburger: a bun group, a hamburger group, a cheese group, and a lettuce-and-tomato group.

Procedure

1. Divide the class into groups of 3–5 students. Distribute a large sheet of chart paper and several markers to each group. Have each group choose their farm-to-store food.
2. Have students draw the food as it is on the farm in the upper left-hand corner of the chart paper. Draw the food as it appears in the store in the lower left-hand corner. Their task is to fill in all the steps that happen in between using pictures, words, and arrows.
3. You may give each group a small stack of index cards so they can write out all their steps and order them before they create their diagram on the chart paper.
4. After all groups have finished their diagrams, have each group present their diagram to the class. Encourage students to ask questions of the presenters.
5. You may post these in the classroom for students to look at as they study food systems. Please have students go back to these at the end of their food-system studies to decide how they would change their diagram based on what they have learned.

FIGURE 2 Pre- and postactivity test responses

Question: Describe all the steps involved in getting strawberries from a farm in California to a jar of strawberry jam sold in a New York City grocery store.

Pre	Post
First you have to cut the strawberries from a tree. Second you put the strawberries in a box. Three you send them to the city in a car.	Cut down all the good strawberries and send them to the factory. The factory they would turn the strawberries into jam and they would package it up. Then they would get to a store.
I think they smash the strawberries and then they put it in a bottle and sell it	They get strawberries. Take it to a factory. In the factory will make into jam. They take to another factory to put in a glass. Then they take it to New York.

Question: Farmers are scientists. (Students decided their level of agreement with this statement from strongly disagree to strongly agree and then wrote the reason for their answer.)

Pre	Post
(strongly disagree) They are not because they only get food.	(agree) I think they are scientists because they have to know about microorganisms.
(strongly disagree) Farmers only know about planting not about outer space or like about light.	(agree) Because they sometimes do what real scientists do like they help produce and process things, just like scientists.

drawings of the fruit and are detailed and accurate. (For the full lesson plan for this activity, including student sheets with outlines of the fruit for drawing detailed observations, please go to www.tc.edu/life and click on the “Farm to Table and Beyond” section.) Students may even enhance their observations by taking photographs of the fruit. Then, either store the fruit in the classroom in sealed viewing boxes or bring the fruit home and store it at room temperature until it begins to rot. Wait until the fruits have significant evidence of microorgan-

isms growing on them—this will take about one to two weeks, depending on the initial condition of the fruit and the temperature and humidity in your home. Then, bring the fruit back to the classroom and have students again observe the physical characteristics of the same piece of fruit they observed on the first day of the experiment. Have students compare their initial observations with their observations of the rotting fruit. Then, have students develop hypotheses that will help to explain why the changes occurred (see Activity Worksheet).

Follow this up with a discussion about what microorganisms need to grow—water, appropriate temperature, air, and a food source—and discuss what can be done to preserve these foods. Grapes can be dried to remove enough water that microorganisms cannot grow. Most students are aware that raisins can last a long time without microbial growth. Tomatoes can be canned, where they are heated to kill microorganisms and then sealed so that there is no air and no exposure to new microorganisms. Strawberries can be frozen, which makes the temperature cold enough to inhibit microbial growth. After completing this investigation and discussion, students begin to understand why we need to preserve food, and how different preservation methods work to prevent microbial growth.

Conclusion

Research suggests if students develop a solid understanding of the food system, they can apply it to make choices that not only promote personal health, but also are socially and environmentally responsible. To assess how students develop an understanding of the food system and if they could apply this to their lives, we gave a group of students in New York City assessment questions to answer before and after studying Farm to Table and Beyond (see Figure 2). When compared to the preactivity answers, the postactivity answers show increased discussion of the parts of the food system, how the parts interact, the role of science and technology in the food system, and how to apply their food-system conceptual understandings to their daily choices. Based on these findings, we have advocated for the use of food and food systems as one approach to project-oriented instruction. Food-systems investigations build on students' familiarity with food. Eating is necessary for survival. It is also a social practice. Students generally have a variety of stories and experiences to share. Instruction that seriously builds on what students know and care about can serve as a hook that gives them ownership of the content being learned. ■

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Activity Worksheet

Why we need to preserve food

In this investigation, you are going to see what happens to a grape, strawberry, and a tomato that are left out at room temperature. You will observe these foods today. Please fill in your observations in the preinvestigation observation column of the table. Your teacher will take the food home and bring it back in a week or so for you to record observe how the food changed when it was left out at room temperature.

	Preinvestigation observations	Postinvestigation observation	Hypothesis on why the pre- and post observations were different
Color			
Size			
General properties (such as condition of the skin and any blemishes or abnormalities)			

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Resource

Farm to Table and Beyond module—www.tc.edu/life/farmtotable.html

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