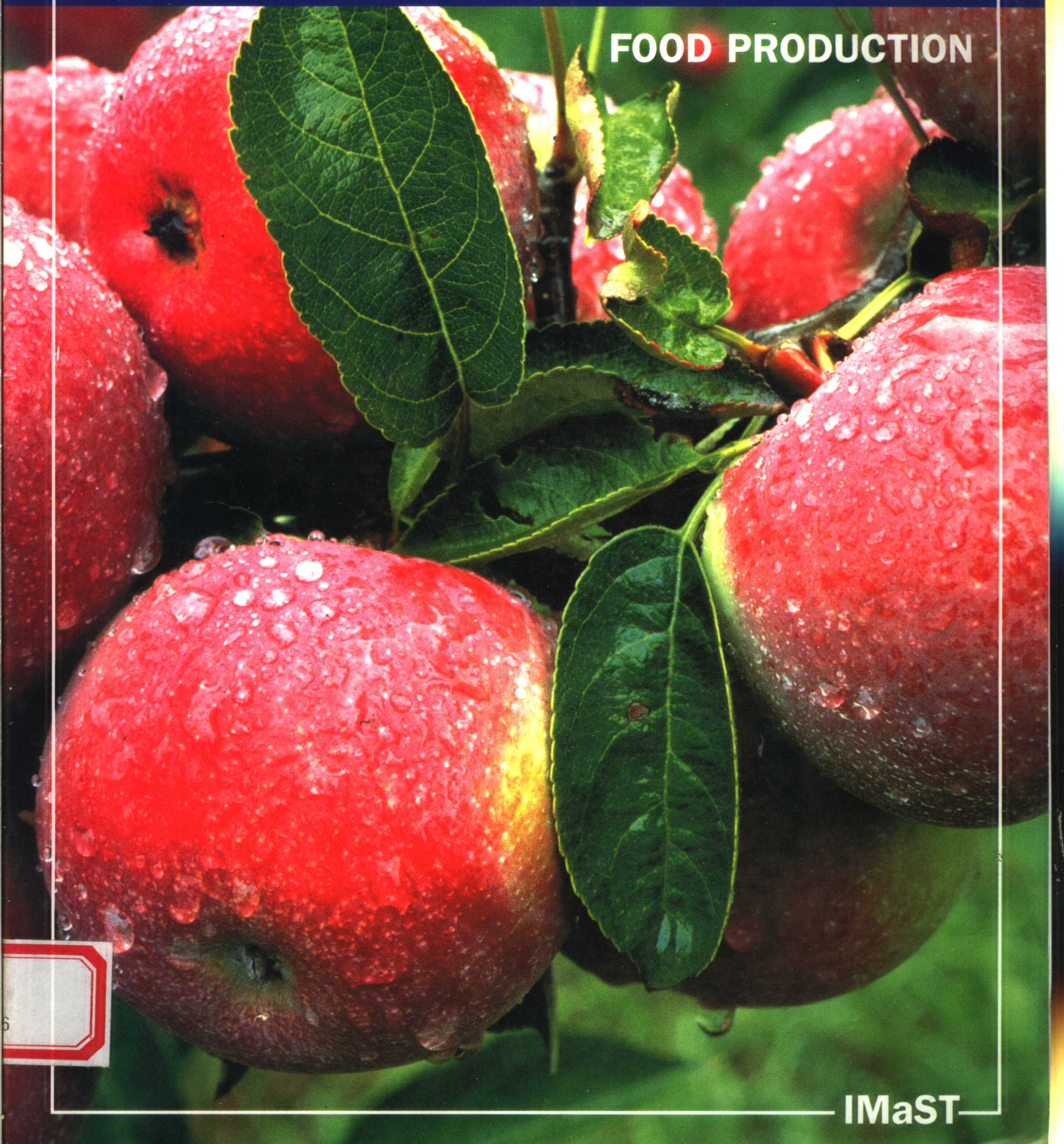
Integrated Mathematics, Science, and Technology



FOOD PRODUCTION

IMaST

Food Production

Integrated Mathematics, Science, and Technology (IMaST) Project

Center for Mathematics, Science, and Technology Education (CeMaST)

Illinois State University

This material is based on work supported by the National Science Foundation under Grant No. 9252934. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect those of the National Science Foundation.

Glencoe McGraw-Hill

New York, New York Columbus, Ohio Woodland Hills, California Peoria, Illinois

Glencoe/McGraw-Hill

A Division of The McGraw-Hill Companies

Send all inquiries to:
Glencoe/McGraw-Hill
3008 W. Willow Knolls Drive
Peoria, IL 61614

ISBN: 0-02-647840-4 (Student Text)
ISBN: 0-02-647842-0 (Teacher's Resource Binder)
ISBN: 0-02-647841-2 (Journal Sheets)

Printed in the United States of America

2 3 4 5 6 7 8 9 10 11 12 079/079 02 01 00 99 98

Acknowledgments

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Acknowledgment is also extended to the middle-school teachers, students, and administrators who provided valuable feedback to the Project staff. This feedback was used to guide the revision process.

Acknowledgment is also extended to the mathematicians, scientists, engineers, and technologists who reviewed the activities as content experts. They provided a valuable check on the validity of the content for each activity.

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Credits

Cover Design: Design Office, San Francisco, CA

Cover Photo: Peter Griffith/Masterfile

Interior Design: Bill Smith Studio, New York, NY

Arnold & Brown, 6, 9, 12, 15, 17, 18, 33, 34, 35, 36, 44, 46, 47, 48, 52, 53, 54, 55, 57, 58, 65, 68, 70, 72, 78, 80, 81, 82, 83, 88, 94, 100, 103, 112, 127, 135, 140, 144, 145, 149, 150, 153

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Special thanks to Yates City Hydro Farm, Yates City, IL for their assistance with photographs in this book.

Models have been used to portray examples in this text.

CONTENTS

Food Production

Challenge ➤ Investigations

What will you learn in this module? How can you prepare yourself for the mathematics, science, and technology activities?

Mathematics

How do you collect data? How can graphs be used to organize, communicate, and analyze data? You'll learn the answers to these questions, plus you'll make scale drawings and use a checking account in these mathematics activities.

Science

What are the best conditions for plant growth? What's in soil that's important for plant growth? How do seeds grow into plants? What makes plants green? How are flowers involved in a plant's life cycle?

Technology

Learn about hydroponics. Design and construct a hydroponics system. Raise a crop the hydroponic way. Harvest your crop. Could hydroponics be one solution to meeting the world's food needs?

Putting It All Together

What factors affect the amount of food available for the world's population, and how can we ensure that the world can meet the food needs of present as well as future generations? Three important factors to consider are population, government policies, and food production methods.

Technology (Cont'd)

FOOD PRODUCTION

at a glance

Food Production Themes:

- *Select*
- *Prepare*
- *Propagate*
- *Nurture*
- *Harvest*

Challenge

The Food Production Challenge introduces you to the topic of food production—the growing of plants and animals for human consumption. You will participate in a simulation game that will allow you to explore lifelike food and hunger issues.

Investigations

The Investigations section of this module contains mathematics, science, and technology activities that will help you explore and understand food production. Each activity has four phases: Exploring, Getting the Idea, Applying the Idea, and Expanding the Idea.

Exploring

In the Exploring phase, you will make observations and collect data. Often, you'll be asked to make predictions. Don't worry about getting the "right" answers. Explorers aren't sure about what they'll find until they get there!

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mathematics • science • technology • mathem

Putting It All Together

Putting It All Together wraps up your study of food production. In earlier sections, you will have learned what must be done to successfully raise animals and crops to produce food. In this section, you will examine some of the factors that affect food production and hunger in our world. Then you will be asked what actions you would take to ensure that the world's food production is able to meet the world's food needs—both now and in the future.

Getting the Idea

In Getting the Idea, you'll participate in class discussions. You'll share the data you collected during Exploring and talk about your observations. You'll form ideas to explain the data and observations.

Applying the Idea

Will the ideas you have work? Does the explanation you developed for one situation apply to other situations? In this phase of the activity, you'll try out your ideas.

Expanding the Idea

OK, now you've figured it out. Why not learn more about the subject or apply your knowledge in new ways? Who knows, you might make some very interesting discoveries.

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DAPIC

a problem-solving

There are five main parts to the DAPIC problem-solving process:

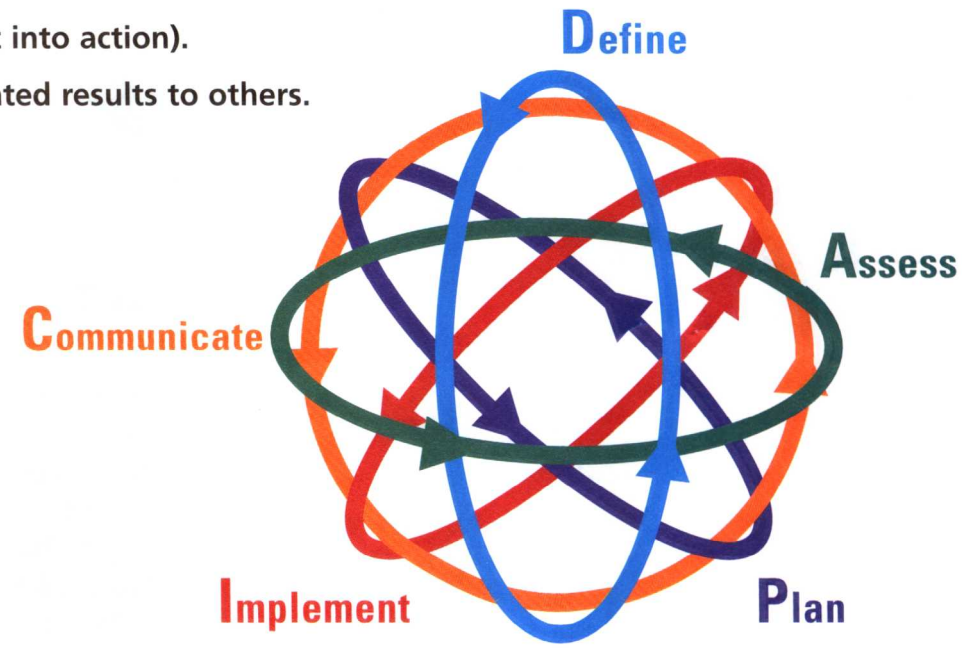
***D**efine* the problem or the challenge.

***A**ssess* the situation.

***P**lan* how to solve the problem.

***I**mplement* the plan (put it into action).

***C**ommunicate* your evaluated results to others.



The goal of this module is to help you solve problems and make informed decisions concerning the appropriate use of materials and technology to produce food. As you participate in the activities, you will follow a problem-solving process called DAPIC.

process

The DAPIC process helps you tackle challenges and make decisions. You can apply it to many kinds of problems. For example, in this module you are challenged to make informed decisions about the appropriate use of materials and technology to produce food. Here's how you might apply DAPIC:

Define the problem or the challenge (how to best use materials and technology to produce food).

Assess or evaluate the growing environment and the growing materials.

Plan to use available materials and technology to grow food in this growing environment.

Implement your plan.

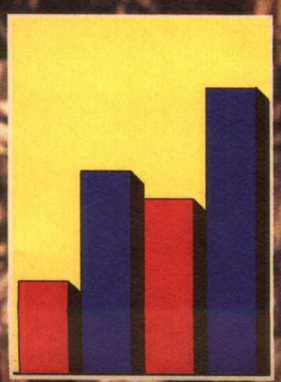
Communicate the results of your implemented plan as well as any modifications you may have needed to make to ensure success.

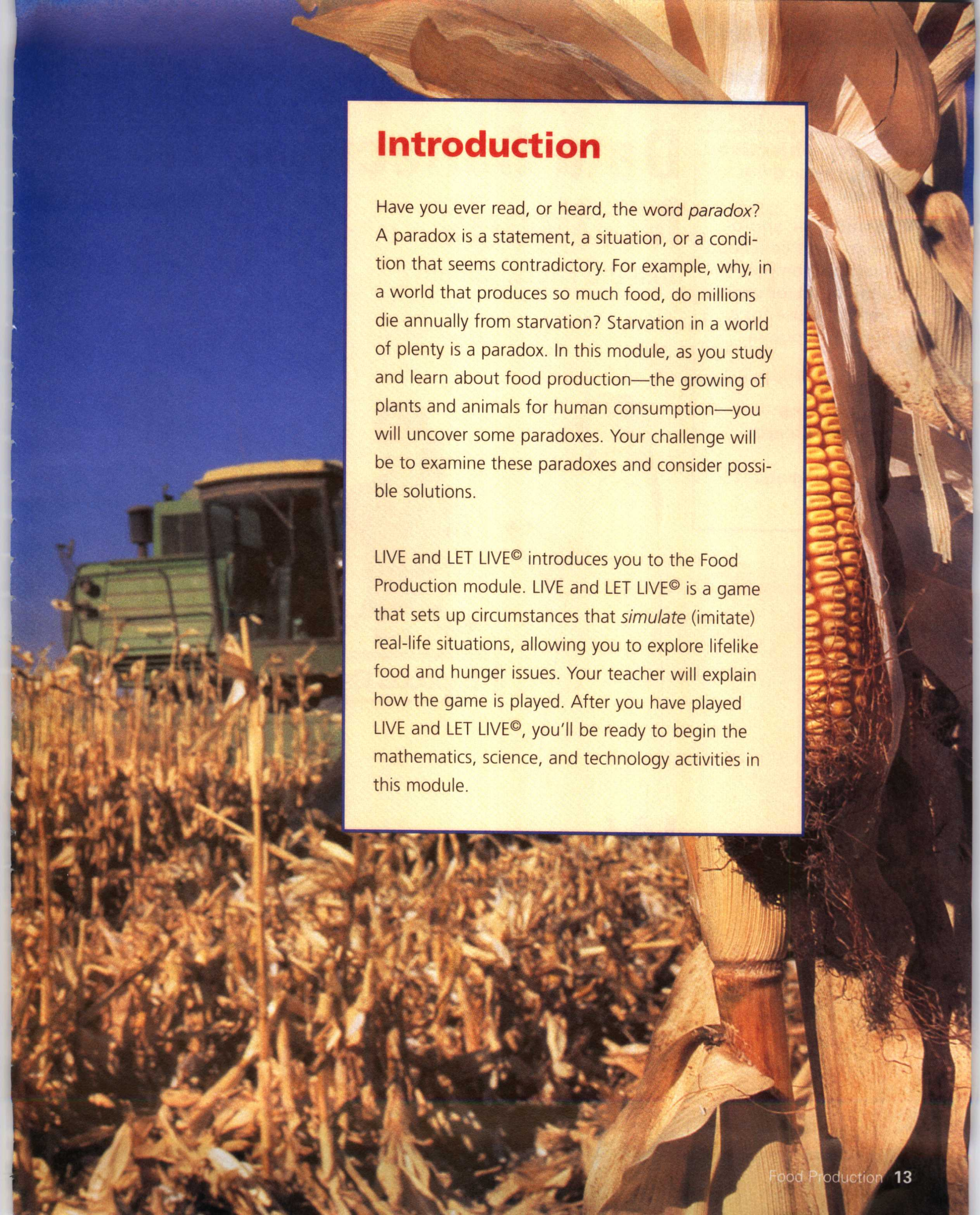
Although this process is described as D-A-P-I-C (and begins with the letter "D" for Define), the process has no definite starting point or order. DAPIC is not a series of "steps" that must be followed in the same order each time. Sometimes, you may want to start at a different point (such as at "I" for Implement) and proceed in a different order (such as to "A" for Assess).

FOOD PRODUCTION
Challenge

Module Objective

Given a food production problem, use the DAPIC process to make informed decisions concerning the appropriate use of materials and technology to produce food.





Introduction

Have you ever read, or heard, the word *paradox*? A paradox is a statement, a situation, or a condition that seems contradictory. For example, why, in a world that produces so much food, do millions die annually from starvation? Starvation in a world of plenty is a paradox. In this module, as you study and learn about food production—the growing of plants and animals for human consumption—you will uncover some paradoxes. Your challenge will be to examine these paradoxes and consider possible solutions.

LIVE and LET LIVE© introduces you to the Food Production module. LIVE and LET LIVE© is a game that sets up circumstances that *simulate* (imitate) real-life situations, allowing you to explore lifelike food and hunger issues. Your teacher will explain how the game is played. After you have played LIVE and LET LIVE©, you'll be ready to begin the mathematics, science, and technology activities in this module.

Activity Objective
During this activity, you will:

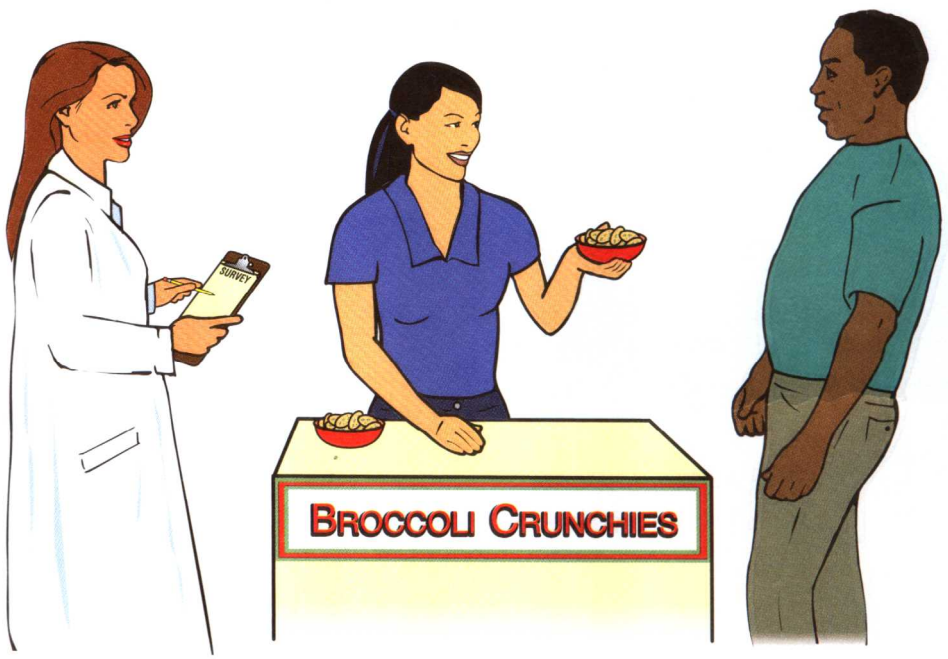
- identify the appropriate data collection method (sample, simulation, or experiment) to use for a specific problem.

Career Connections

- market research analyst
- purchasing agent
- statistician

Data Collection Methods

Just the Facts, Ma'am



When people ask questions, they get answers. It's important to ask questions that will provide the answers you need. Information you receive from the questions can be one type of data. Where do you find data? How do you collect data? There are specific methods or processes used to collect data. Three methods often used are: **sampling, simulating,** and **experimenting.** Each of these methods allows you to collect data in different ways.

This information will help you decode, or understand, the meaning of words used in this activity.

sample: A small portion of a population chosen to represent the whole population when attempting to determine what the whole population is like. To be reliable, the sample must be representative of the whole population.

simulation: Using props and/or symbols to set up circumstances *simulating* (imitating) a real-life situation. The props and/or symbols are used to act out a likely scenario in order to determine the probable outcome under real-life circumstances. Simulations can help you understand situations and make predictions.

experiment: To develop and carry out a series of logical steps to discover something not yet known, to demonstrate or test something known, or to test a *hypothesis* (theory or educated guess) by controlling and changing *variables* (conditions that can be changed or manipulated). During the course of the experiment, the investigator makes observations and collects data; this information is used as evidence when analyzing results and drawing conclusions.

survey: A set of questions directed to a sample of a population to describe, explain, or explore characteristics of a similar larger population.

Exploring

Sampling

You will need Journal Sheet M1-1, Agricultural Occupation Survey, for this portion of this activity.

1. Suppose that you and your friends want to make some extra money and are looking for after-school jobs. There are agriculture-related jobs open in your community. You would all like to work together at the same job. Do you think you and your friends would select the same job? What jobs might interest adults? To collect the data that will help you answer these questions, you will select a sample and use a **survey**. Use the Agricultural Occupation Survey Journal Sheet. Discuss the jobs listed on this survey. Be sure you understand each job description.
2. Discuss the difference between data *collection* methods and data *recording* methods.
3. Brainstorm with classmates for ways to record data.
4. Ask ten students *outside* this class and ten adults which <u>one</u> occupation listed on the Survey Sheet they prefer. Indicate each person's preference in the appropriate column. (You do not need to name the people you interview.)

5 After conducting your survey, combine with a partner and tally the occupations chosen by the ten students on both your and your partner's surveys. Do the same for the responses from the ten adults.

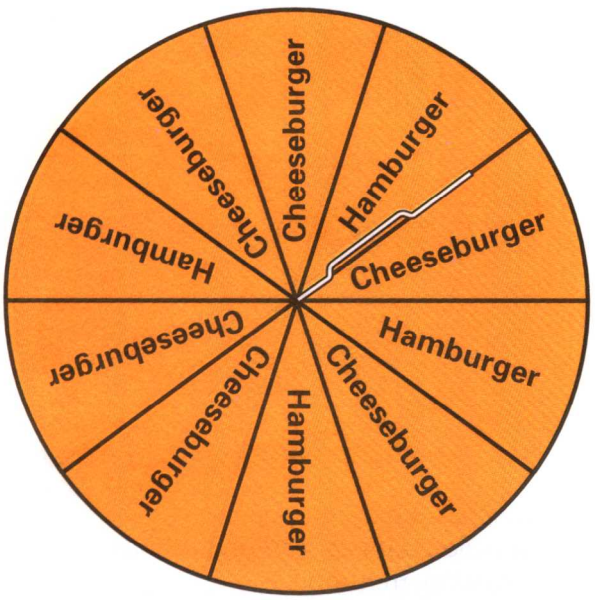
6 Report your findings to the class. Make a chart of the results of all the class members' surveys.

Simulating

You will need a copy of Journal Sheet M1-2 for this portion of the activity.

1 Use a compass and a protractor to construct a circle. Divide the circle into ten equal segments. Each segment will represent a hamburger or a cheeseburger. Mark the segments to show that six out of ten people order cheeseburgers and four out of ten people order hamburgers.

2 Use a paper clip to make a spinner and place it at the center of the circle you made in #1.



3 Now, imagine that you are in charge of preparing enough hamburgers and cheeseburgers for one-half hour of food service in a local restaurant. If ten people order food during this half hour, how many cheeseburgers and hamburgers would you estimate that you might prepare? Record your estimates in the table on your Journal Sheet.

4 Now spin the spinner ten times to simulate the ten orders. How close were your estimates? How many extra cheeseburgers or hamburgers than estimated would you have to make? How many cheeseburgers or hamburgers would you have left over? Enter this information in the table on your Journal Sheet.

5 Is using a simulation an accurate way to predict the number of cheeseburgers and hamburgers to prepare? Why or why not?

6 Repeat the ordering process (spin) for ten more orders, and enter this information on your Journal Sheet. Then compare these results to the results from your first simulation.

7 Repeat the ordering process (spin) for another ten orders, and enter the results on your Journal Sheet. Compare these results to the previous two sets of data.

8 Average your results for all three trials, and record the average for each type of burger on your Journal Sheet. How close are these *averages* to the original circle graph you made in Step #1 that showed six out of ten people order cheeseburgers and four out of ten order hamburgers?

9 Suppose the restaurant routinely made six cheeseburgers and four hamburgers at the beginning of each half hour. Their cost for a cheeseburger is $.95, while their cost for a hamburger is $.85. *Based on the average amounts you computed in #8*, did they lose money due to hamburger waste? Did they lose money due to cheeseburger waste? If there was any waste, how much money was lost due to this waste? Record your answers on your Journal Sheet.

10 Suppose that when the restaurant runs out of pre-made cheeseburgers and must make another cheeseburger to meet a customer's order, it costs the restaurant an additional $1.00 in labor and materials. How much in extra costs (if any) were incurred in each of your simulations? Record each amount on your Journal Sheet.