

Glencoe

Introduction to

# TECHNOLOGY

Alan J. Pierce

Dennis Karwatka



**Glencoe**

## SAFETY NOTICE

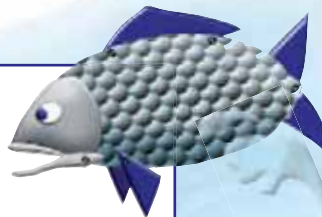
The reader is expressly advised to consider and use all safety precautions described in this book or that might also be indicated by undertaking the activities described herein. In addition, common sense should be exercised to help avoid all potential hazards.

Publisher and Authors assume no responsibility for the activities of the reader or for the subject matter experts who prepared this book. Publisher and Authors make no representation or warranties of any kind, including but not limited to, the warranties of fitness for particular purpose or merchantability, nor for any implied warranties related thereto, or otherwise. Publisher and Authors will not be liable for damages of any types, including any consequential, special, or exemplary damages resulting, in whole or in part, from reader's use or reliance upon the information, instructions, warnings, or other matter contained in this book.

Notice: Information on featured companies, organizations, and their products and services is included for educational purposes only and does not present or imply endorsement of the *Introduction to Technology* program.

### On the Cover

**Aquatic Robotics** The fish you see on the cover of *Introduction to Technology* is actually a robot. It is a real-life technology tool called a "robo-carp" that swims with real fish in the London Aquarium. Engineered by scientists at the University of Essex in England, this fish uses artificial intelligence and an infrared sensor in its mouth to detect and avoid obstacles. It was created to sniff out underwater mines, leaky oil pipes, and more.



The McGraw-Hill Companies

Copyright © 2010 The McGraw-Hill Companies, Inc. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written consent of The McGraw-Hill Companies, Inc., including, but not limited to, network storage or transmission, or broadcast for distance learning.

Printed in the United States of America.

Send all inquiries to:  
Glencoe/McGraw-Hill  
21600 Oxnard Street, Suite 500  
Woodland Hills, California 91367

ISBN: 978-0-07-879785-9 (Student Edition)  
MHID: 0-07-879785-3 (Student Edition)  
ISBN: 978-0-07-890711-1 (Teacher Annotated Edition)  
MHID: 0-07-890711-X (Teacher Annotated Edition)

2 3 4 5 6 7 8 9 043/071 13 12 11 10 09

# About the Authors

**Dr. Alan J. Pierce** has served as an educator at the elementary, middle, and college levels for more than 40 years. Dr. Pierce has authored numerous articles in the field of education, co-authored curriculum projects, and served as a technical consultant on a children's technology book. He is an editor and writer of the middle school Agricultural Biology curriculum for the NSF-funded TECHknow project at North Carolina State University. Dr. Pierce created the "Technology Today" column for *Tech Directions* magazine and has been writing this column since 1995.

**Dennis Karwatka** was a professor in the Department of Industrial Education and Technology at Morehead State University. He taught for many years in the high school Upward Bound Program. He has written two middle/high school textbooks, five technical history books, and many articles. Dennis Karwatka created the monthly "Technology's Past" column in *Tech Directions* and has been writing that column since 1980. He is a Registered Professional Engineer with experience in the Apollo lunar landing program and jet engine development.

## Contributing Writer

### Thomas Shown

Industrial Technology & Human Services  
North Carolina Department of Public Instruction  
Raleigh, North Carolina  
Technology Students Association  
Member of Competition Regulations Committee

## Our McGraw-Hill Partner

**BusinessWeek** is the leading global resource for ground-breaking business news and news analysis that offers essential insight into the real world of business, technology, education, and other areas. *BusinessWeek* is the world's most widely read business magazine in print and online with more than 8 million weekly readers.

# Reviewers and Advisors

## Educational Reviewers

*We wish to acknowledge the contributions of the following reviewers:*

### Lane Beard

St. James Parish Career and Technology Center  
Lutcher, Louisiana

### Courtney Bullock

Walter Reed Middle School  
Studio City, California

### LaMarr Brooks

Pendleton High School  
Pendleton, South Carolina

### Lewis H. Chappellear

James Monroe High School  
North Hills, California

### Lisa K. Coleman

Gautier High School  
Gautier, Mississippi

### Eric Elder

Warren East Middle School  
Bowling Green, Kentucky

### Michael Fontaine

Murdock Middle High School  
Winchendon, Massachusetts

### Ed Hamilton

Berryhill High School  
Tulsa, Oklahoma

### Lauren Withers Olson

Biloxi Junior High  
Biloxi, Mississippi

### Tim Schultz

Lafayette Tecumseh Junior High School  
Lafayette, Indiana

## Trade and Technology Industry Advisory Board

### Johan Gallo

Manager of Human Resources  
Government and Agency Affairs  
Bridgestone-Firestone  
Laguna Hills, California

### Cheryl Horn

Corporate Manager, Community Relations  
Northrop Grumman Corporation

### Erin Kuhlman

Vice President, Corporate Relations  
Parsons, Inc.  
Pasadena, California

### Donna Laquidara-Carr

National Training Manager  
McGraw-Hill Construction  
Lexington, Massachusetts

### Floyd McWilliams

Executive Vice President  
American Design Drafting Association  
Program Director, Drafting  
Anthem College  
Phoenix, Arizona

### Olen Parker

Executive Director  
American Design Drafting Association  
Nashville, Tennessee

### Robert Ratliff

President  
The Manufacturing Institute  
Cumming, Georgia

### Joe Vela

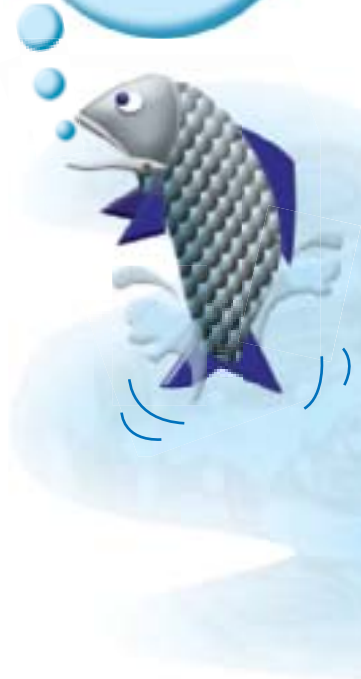
Associate Principal  
AEDIS Architecture & Planning  
San Jose, California

# Table of Contents

## unit 1 The Nature of Technology ..... 2

<b>Chapter 1</b>	<b>Why Study Technology?</b> .....	4
Section 1.1	Technology and You .....	6
Section 1.2	Making Technology Happen .....	10
Section 1.3	How Technology Changes .....	13
	<b>Review and Assessment</b> .....	18
	<b>TECHNOLOGY LAB</b> Build a High-Tech Paper Airplane .....	20
<b>Chapter 2</b>	<b>Concepts of Technology</b> .....	22
Section 2.1	Technology Resources .....	24
Section 2.2	Technology Systems .....	31
Section 2.3	Developing a System or Product .....	35
	<b>Review and Assessment</b> .....	40
	<b>TECHNOLOGY LAB</b> Design and Build a Game of Skill .....	42
<b>Chapter 3</b>	<b>Processes, Tools, and Materials of Technology</b> .....	44
Section 3.1	Technology Processes .....	46
Section 3.2	Tools and Machines .....	52
Section 3.3	Engineering Materials .....	60
	<b>Review and Assessment</b> .....	66
	<b>TECHNOLOGY LAB</b> Make a Plaster Casting .....	68

Look for  
**STEM** practice  
 and  
**TSA** event  
 practice  
 in all Chapter Review  
 and Assessments.



# Table of Contents



## Chapter 4 Design and Problem Solving ..... 70

Section 4.1 The Design Process ..... 72

Section 4.2 Problem Solving ..... 76

**Review and Assessment** ..... 82

**TECHNOLOGY LAB** Design a Product to Overcome a Disability ..... 84

## Chapter 5 From Drawings to Prototypes ..... 86

Section 5.1 The Graphic Language ..... 88

Section 5.2 Drafting Applications ..... 98

Section 5.3 Building Models and Prototypes ..... 102

**Review and Assessment** ..... 106

**TECHNOLOGY LAB** Make a Back-Massage “Vehicle” ..... 108

## Chapter 6 Technology Connections ..... 110

Section 6.1 Science and Mathematics ..... 112

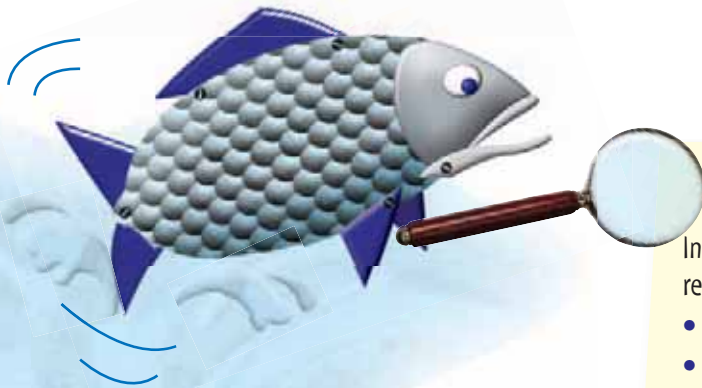
Section 6.2 Language Arts and Social Studies ..... 116

**Review and Assessment** ..... 122

**TECHNOLOGY LAB** Produce a Documentary Video ..... 124

*Technology Time Machine* On Technology’s Trail ..... 126

**Unit 1 Thematic Project** Redesigning an Invention ..... 128



### Reading Strategies

In each section, look for these reading strategies:

- Before You Read
- Graphic Organizer
- Reading Check
- As You Read
- After You Read

## unit 2 Energy and Power Technologies ..... 130

<b>Chapter 7</b>	<b>Energy and Power for Technology</b> .....	132
	Section 7.1 Energy Basics .....	134
	Section 7.2 Converting Energy to Power .....	142
	Section 7.3 Impacts of Energy and Power Technology .....	147
	<b>Review and Assessment</b> .....	154
	<b>TECHNOLOGY LAB</b> Build a Solar Heating System .....	156
<b>Chapter 8</b>	<b>Electricity to Electronics</b> .....	158
	Section 8.1 Electricity Basics .....	160
	Section 8.2 Controlling Electrical Flow .....	166
	Section 8.3 Electronics .....	170
	<b>Review and Assessment</b> .....	176
	<b>TECHNOLOGY LAB</b> Build a Simple Alarm System .....	178
	<i>Technology Time Machine</i> The Essence of Energy .....	180
	<b>Unit 2 Thematic Project</b> Designing Alternative Power Plants. ....	182

## unit 3 Communication Technologies ..... 184

<b>Chapter 9</b>	<b>Communication Systems</b> .....	186
	Section 9.1 Introducing Communication Technology .....	188
	Section 9.2 Modes of Communication .....	196
	Section 9.3 Impacts of Communication Technology .....	199
	<b>Review and Assessment</b> .....	204
	<b>TECHNOLOGY LAB</b> Create an Ad .....	206
<b>Chapter 10</b>	<b>Computer Technologies</b> .....	208
	Section 10.1 Computer Systems .....	210
	Section 10.2 Computers on the Cutting Edge .....	217
	<b>Review and Assessment</b> .....	222
	<b>TECHNOLOGY LAB</b> Program a Computer to Control a Machine. ....	224



# Table of Contents



<b>Chapter 11</b>	<b>Graphic Communications</b> .....	226
	Section 11.1 Printing Processes .....	228
	Section 11.2 Producing a Graphic Message .....	237
	<b>Review and Assessment</b> .....	242
	<b>TECHNOLOGY LAB</b> Create a Graphic Communication Product .....	244
<b>Chapter 12</b>	<b>Photographic Technologies</b> .....	246
	Section 12.1 Cameras .....	248
	Section 12.2 Recording the Image .....	252
	Section 12.3 Processing the Image .....	256
	<b>Review and Assessment</b> .....	260
	<b>TECHNOLOGY LAB</b> Process Photographs .....	262
<b>Chapter 13</b>	<b>Multimedia Technologies</b> .....	264
	Section 13.1 Audio and Video Technologies .....	266
	Section 13.2 Multimedia Applications .....	271
	<b>Review and Assessment</b> .....	278
	<b>TECHNOLOGY LAB</b> Create a Multimedia Web Page .....	280
	<b>Technology Time Machine</b> Communication Through Computers .....	282
<b>Unit 3 Thematic Project</b>	Shopping Online or In-Store .....	284

## Reading Strategies

In each section, look for these reading strategies:

- Before You Read
- Graphic Organizer
- Reading Check
- As You Read
- After You Read





# Table of Contents

## unit 4 Biotechnologies.....286

### Chapter 14 Medical Biotechnologies ..... 288

Section 14.1 Disease Prevention ..... 290

Section 14.2 Diagnosis of Disease ..... 297

Section 14.3 Treatment of Disease ..... 301

**Review and Assessment** ..... 306

**TECHNOLOGY LAB** Crash Test a Vehicle ..... 308

### Chapter 15 Agricultural Biotechnologies..... 310

Section 15.1 Farming Technologies..... 312

Section 15.2 New Breeding Technologies..... 318

Section 15.3 Other Agricultural Technologies ..... 323

**Review and Assessment** ..... 328

**TECHNOLOGY LAB** Construct a Hydroponic System ..... 330

*Technology Time Machine* Understanding Genetics ..... 332

**Unit 4 Thematic Project** Discovering Careers  
in Biotechnology ..... 334

## unit 5 Manufacturing Technologies ..... 336

### Chapter 16 Manufacturing Systems ..... 338

Section 16.1 The Evolution of Manufacturing ..... 340

Section 16.2 Organizing a Manufacturing System..... 344

Section 16.3 Running Your Own Factory ..... 349

**Review and Assessment** ..... 354

**TECHNOLOGY LAB** Manufacture a Bookstand ..... 356

### Chapter 17 Manufacturing in the 21st Century..... 358

Section 17.1 Preparing for Manufacturing..... 360

Section 17.2 Producing the Product ..... 364

Section 17.3 Selling the Product ..... 368

**Review and Assessment** ..... 372

**TECHNOLOGY LAB** Test Products..... 374

*Technology Time Machine* Evolution of the Factory .... 376

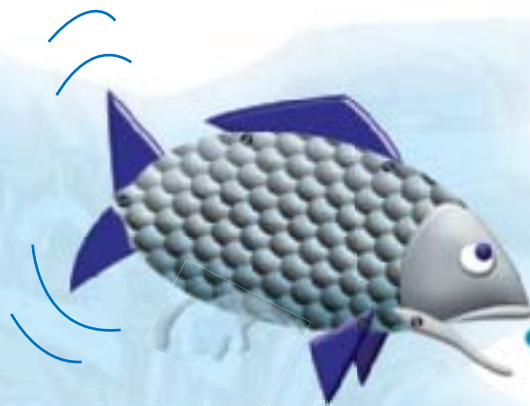
**Unit 5 Thematic Project** Making Things Real ..... 378



# Table of Contents

## unit **6** Construction Technologies ..... 380

<b>Chapter 18</b> The World of Construction .....	382
Section 18.1 The Evolution of Construction .....	384
Section 18.2 Design Requirements .....	391
<b>Review and Assessment</b> .....	398
<b>TECHNOLOGY LAB</b> Test the Strength of a Column .....	400
<b>Chapter 19</b> Building a House .....	402
Section 19.1 Homes for People .....	404
Section 19.2 House Construction .....	408
<b>Review and Assessment</b> .....	416
<b>TECHNOLOGY LAB</b> Build a Model House .....	418
<b>Chapter 20</b> Heavy Construction .....	420
Section 20.1 Large Buildings .....	422
Section 20.2 Roadway Projects .....	426
Section 20.3 Other Structures .....	431
<b>Review and Assessment</b> .....	436
<b>TECHNOLOGY LAB</b> Build a Truss Bridge .....	438
<b>Technology Time Machine</b> Construction by Design .....	440
<b>Unit 6 Thematic Project</b> Planning a Green Shelter .....	442



Look for  
**STEM** practice  
and  
**TSA** event  
practice  
in all Chapter Review  
and Assessments.



## unit 7 Transportation Technologies ..... 444

<b>Chapter 21</b>	<b>Transportation Power</b> .....	446
	Section 21.1 External Combustion Engines .....	448
	Section 21.2 Internal Combustion Engines.....	452
	Section 21.3 Electric Motor.....	459
	<b>Review and Assessment</b> .....	464
	<b>TECHNOLOGY LAB</b> Build a Steam Turbine .....	466
<b>Chapter 22</b>	<b>Transportation Systems</b> .....	468
	Section 22.1 Land Transportation .....	470
	Section 22.2 Water Transportation .....	477
	Section 22.3 Air and Space Transportation.....	481
	<b>Review and Assessment</b> .....	486
	<b>TECHNOLOGY LAB</b> Build a Rubber-Band-Powered Vehicle.....	488
	<b>Technology Time Machine</b> As the Wheel Turns.....	490
	<b>Unit 7 Thematic Project</b> Advancing Transportation.....	492
	<b>Appendix—STEM Handbook</b> .....	494
	<b>Academic Vocabulary Glossary</b> .....	532
	<b>Content Vocabulary Glossary</b> .....	535
	<b>Index</b> .....	546
	<b>Photo Credits</b> .....	560

## Welcome to Introduction to Technology

### Explore Your Textbook

Technology is everywhere. Did you know that you use technology each time you ride in a car, talk on a phone, watch TV, play computer games, or read a book? Start exploring your textbook so you can understand, use, design, and even make technology!

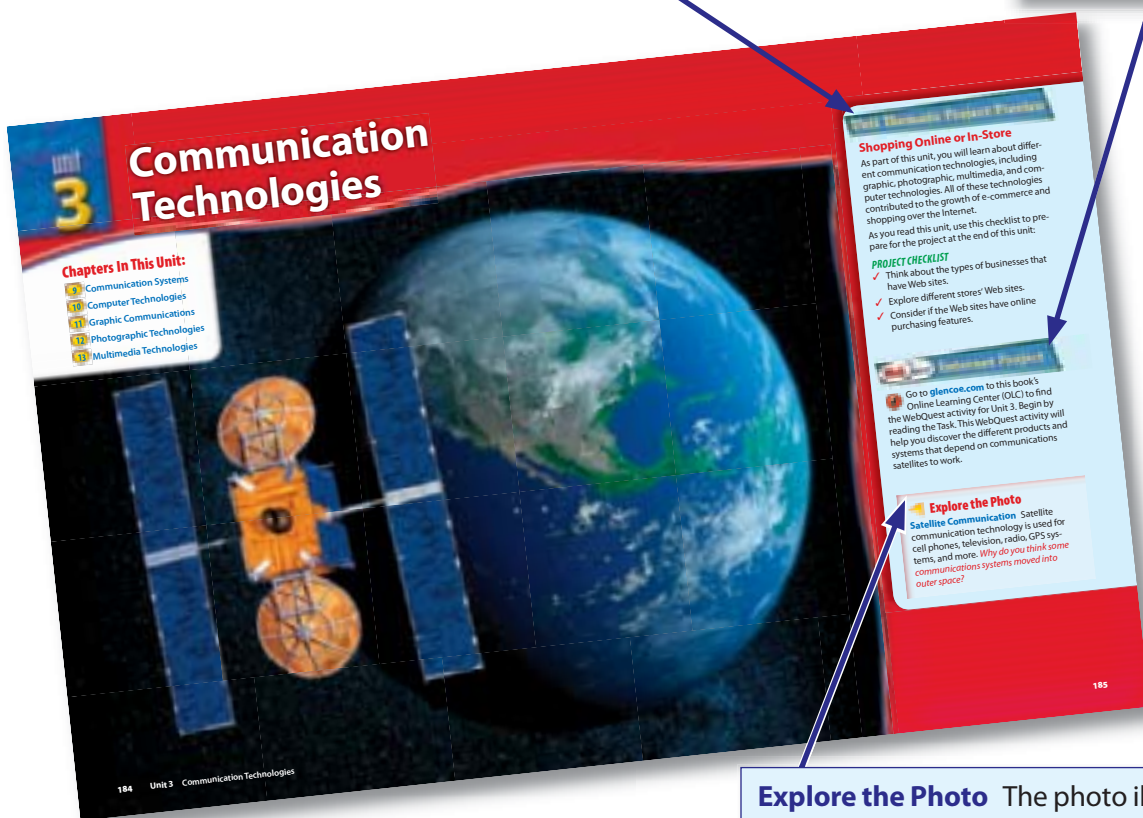
### Units

*Introduction to Technology* has seven units. Each unit contains two to six chapters. The units explore all the major types of technology.

### Unit Opener

**Unit Thematic Project Preview** Read about the project that comes at the end of the unit. Use the Checklist to get a head start on doing the project.

**WebQuest Internet Project** This takes you to the book's Online Learning Center, a Web site where you can do an activity related to the photo.



**Explore the Photo** The photo illustrates a technology concept. Read the caption and answer the question to jump into the unit.



# To the Student

## Discover, Learn, Apply

### Chapters

The chapters of *Introduction to Technology* are organized around subjects that relate to all kinds of technology. Each chapter is divided into two or three sections. Use the reading strategies to get the most out of your studies.

### Chapter Opener

**What You'll Learn** These chapter objectives preview the content you will learn.



**Explore the Photo** A photo visually illustrates chapter content. The caption asks you a question so you can start thinking about what you will read.

**Launch the Technology Lab** Preview a hands-on project and prepare for doing the project at the end of the chapter.

## Practice Your Skills

### Chapter Close—The Technology Lab

At the end of every chapter, you can create your own technology project. You might design an ad, build a model vehicle, or even make a robot!

**Set Your Goal** This section explains your goal for the lab.

**Design Your Project** This section gives you the steps to complete your lab.

**Tools and Materials**

- ✓ Markers, pens, pencils
- ✓ Posterboard
- ✓ Scissors
- ✓ Glue
- ✓ Magazines, books
- ✓ Computer and printer
- ✓ Presentation software
- ✓ Graphics software
- ✓ Scanner
- ✓ Copy machine
- ✓ Video camera

**Create an Ad**

For any invention to become important, people must know about it. They must also be convinced that they need it. If you wanted to tell everyone about a new invention, what mass communication system would you use? In this lab, you will get the chance to design an ad using the communication system of your choice.

**Set Your Goal**

Your goal for this lab is to create an advertisement for a brand new communication device. Some examples might include an iPhone, plasma TV, iPod, or the latest video game. You can also advertise your own futuristic invention. Use the keywords *future* or *new communication* to search the Internet for more ideas.

**Know the Criteria and Constraints**

In this lab, you will:

1. Work in a group of two or three, but no more than four people.
2. Create an interesting print ad, a Web page, a PowerPoint presentation, or a short video advertisement.
3. Design an ad that is serious or funny!
4. Include this information in your ad:
  - The inventor of the device
  - When it was invented
  - What it does
  - Why it is important to the development of technology

**Design Your Project**

Follow these steps to design your project and complete this lab.

1. Choose the invention that your group wants to advertise.
2. Choose the communication method that you will use—print, Internet, presentation software, or video.
3. Brainstorm the theme of your ad. You can study advertisements that you have seen. Be creative and have fun!
4. Spy in your ad who invented the device, when the invention was invented, what it does, and why it is important to the development of technology.
5. Produce your ad using the communication method you chose. You can:
  - Paste up your artwork and text for your graphic ad
  - Use a computer to make a Web page
  - Use PowerPoint presentation software, or
  - Use a video camera to shoot your commercial.
6. Share your advertisement with the class.

**Evaluate Your Results**

After you complete this lab, answer these questions on a separate piece of paper.

1. What do you think makes a new technological development successful?
2. What are the input, process, and output phases of the communication system that you used for your ad?
3. If you were to redo your ad, what would you do differently? Why?

**Academic Skills Required to Complete Lab**

Tasks	English Language Arts	Math	Science	Social Studies
Research new and future communication devices.	✓			
Gather sample advertisements.	✓		✓	✓
Write ad copy that communicates effectively.	✓		✓	✓
Create presentation.	✓			
Present ad to the class.	✓	✓		

Chapter 9 Communication Systems 207

**Criteria and Constraints**  
You need to know the guidelines and limitations of what you will do. Chapter 2 explains the meanings of *criteria* and *constraints*.

**Evaluate Your Results**  
Answer the questions to self-assess your own lab.

# To the Student

## Section Opener

At the beginning of each section, check out the Reading Guide. Develop your reading and comprehension skills as you preview the content, vocabulary, standards, and main ideas for that section.

**Before You Read** A pre-reading question helps you connect to what you will read.

**Graphic Organizer**  
A graphic organizer is a visual tool to help you organize and remember information you learn in the section.

**Content Vocabulary**  
Preview the key terms you will learn in the section. Look for yellow highlighted words as you read.

**Academic Vocabulary**  
You will see these words on tests and in your reading. Look for blue boldface type in the section.

**As You Read** This question helps you focus on a concept in your reading.

**Academic Standards**  
Get skills in English language arts, mathematics, science, and social studies. The section openers list some of the academic standards for the section.

**9.1 Introducing Communication Technology**

**Connect** How do you use technology for communicating?

**Content Vocabulary**

- communication technology
- graphic communication
- sound waves
- electromagnetic carrier wave
- telecommunication

**Academic Vocabulary**

You will see these words in your reading and on your tests. Find their meanings at the back of this book.

- technology
- factor

**TECHNOLOGY STANDARDS**

- STL 2** Core Concepts of Technology
- STL 17** Information & Communication Technologies

**ACADEMIC STANDARDS**

**English Language Arts**

- NCTE 4** Use written language to communicate effectively.
- NCTE 12** Use language to accomplish individual purposes.

**Graphic Organizer**

Draw the section diagram. Use it to organize and write down information as you read.

Forms of Communication	
Biological Communication	
Speaking	

Go to [glencoe.com](http://glencoe.com) to this book's OLC for a downloadable graphic organizer and more.

**Communication and Technology**

*What are some examples of communication technology?*

Imagine you are standing in the hallway at school talking to your friends. Are you using communication? Yes. Communication is sending, receiving, and responding to messages. Are you using communication technology? No. When you are talking face-to-face, you are not using communication technology. However, if you communicate by using a written note, Instant Messaging (IM), or a cell phone, then you are using communication technology. Communication technology is the transfer of messages (information) among people and/or machines through the use of technology. This processing of information can help people make decisions, solve problems, and control machines.

**Predict** Think of different ways to send and receive messages.

188 Unit 3 Communication Technologies



## Features

Interesting features introduce basic technology topics in each chapter. You will also learn about people of the past and present. These features help you see how what you read relates to the real world.

## Margin Features



**Now Hear This!** You have your own built-in sound receivers—your ears. Sound waves striking your eardrums make them vibrate.

**Apply** Find an illustration of the ear in an encyclopedia at school. Make a drawing showing the main parts of the ear. Label the parts and functions.



### Academic Connections

See how technology can link to almost every subject—mathematics, science, English language arts, or social studies.

**EcoTech** Technology can be “green”! This feature shows you how technology can be friendly to our environment. **Try This** gives you ideas that can help.



### Treeless Paper

Making paper from trees can use a lot of energy and toxic chemicals. But paper can also be made from hemp, bamboo, or kenaf—a plant that grows quickly and uses eco-friendly chemicals for production.

**Try This** To save paper, write on both sides of your paper, use scrap paper—and recycle it.



### Computers You Can Wear

Imagine wearing a computer that is a lightweight, voice-activated box with a headset and eyepiece. When you look into the eyepiece, you see a computer screen that appears as if it is a few feet away. Researchers at NASA are working on a model called a Wearable Augmented Reality Prototype (WARP) for astronauts to wear so their hands are free for other tasks. *How might wearing your computer help you in everyday communication?*

Go to [glencoe.com](http://glencoe.com) to this book's OLC for answers and to learn more about NASA and technology.

### Imagine This

Learn about amazing innovations in technology for today and tomorrow.

**BusinessWeek Tech News** This feature appears in a chapter once in every unit. It reports special news on technology.



### Building a Super Cell Phone

The newest wave of tech entrepreneurs is transforming our mobile phones into personal computers. “The most common digital device in the world is the cell phone,” says Motricity’s chief technology officer. Young entrepreneurs are looking to social networking, Internet video, and online photo-sharing. They extend those applications by putting them on cell phones.

**Critical Thinking** *What modes of communication would apply to a super cell phone? Why?*

Go to [glencoe.com](http://glencoe.com) to this book's OLC read more about this news.

# To the Student

## In-Chapter Features

**Tech Stars** This feature profiles an innovator in a technology field that relates to the chapter.



**Tech Stars**

**Tim Berners-Lee**  
*Inventor of the World Wide Web*

When Tim Berners-Lee was a teenager in England, he built a computer using a soldering iron and an old television. Later, he worked as a computer programmer at CERN, a physics laboratory in Geneva, Switzerland. There, he wrote a program with Robert Cailliau for storing information by using "random associations." This idea led to "hyperlinking," which is how the World Wide Web works.

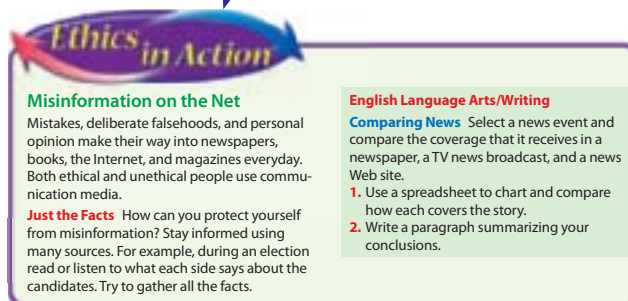
Tim said the World Wide Web should be like a "global hypertext project." It should help people work together through a "web" of documents. The documents could be opened from anywhere on the Web.

**The WC3** In 1994, Tim set up the World Wide Web Consortium (WC3) at the Massachusetts Institute of Technology (MIT). The group manages Web development around the world. Of course, the WC3 has its own Web site at [w3.org](http://w3.org).

**English Language Arts/Writing** Write an article for your school newspaper about spam and how it affects using the Web.

Go to [glencoe.com](http://glencoe.com) to this book's OLC to learn about young innovators in technology.

**Ethics in Action** This feature lets you look at the ethical questions and choices that face the world of technology today.



**Ethics in Action**

**Misinformation on the Net**

Mistakes, deliberate falsehoods, and personal opinion make their way into newspapers, books, the Internet, and magazines everyday. Both ethical and unethical people use communication media.

**Just the Facts** How can you protect yourself from misinformation? Stay informed using many sources. For example, during an election read or listen to what each side says about the candidates. Try to gather all the facts.

**English Language Arts/Writing**

**Comparing News** Select a news event and compare the coverage that it receives in a newspaper, a TV news broadcast, and a news Web site.

1. Use a spreadsheet to chart and compare how each covers the story.
2. Write a paragraph summarizing your conclusions.

**Exploring Careers in Technology**

Read an interview with a real-world person working in technology. Learn about the tasks of the job, the skills and education needed, and the future of the career.



**Exploring Careers in Technology**

**Michael Eisenberg**  
**SOUND ENGINEER**

**Q: What do you do?**  
**A:** I am a freelance sound designer and engineer for theatrical and performing arts events. My typical day includes changing the sound engineering design to ensure that all elements of a production run smoothly and to make sure that the crew understands and executes my design.

**Q: What kind of training and education did you need to get this job?**  
**A:** In high school and later in college, I took several courses in physics, calculus, and electrical engineering. I use math almost everyday to make decisions, like where to locate the sound equipment to achieve the most efficient sound design, while using the least number of microphones and preserving the sound quality.

**Q: What do you like most about your job?**  
**A:** I enjoy being able to help enhance the performance experience of an audience. I am always curious about the audience's likes and dislikes, and I want them to hear something different.

**Q: How did you get interested in your job?**  
**A:** I became extremely interested in sound design and mixing in high school. The theater teachers at my school sparked my interest and gave me opportunities and an outlet to do something that I felt I could call my own.

**English Language Arts/Writing**

**Career Search** Create a list of ten careers that require speaking and listening skills.

1. Using a spreadsheet program, make a chart of the different careers, including their characteristics.
2. Select the career that interests you the most.
3. Research the type of formal education you would need to pursue the career you chose.

Go to [glencoe.com](http://glencoe.com) to this book's OLC to learn more about this career.

Speaking, listening, problem-solving

Physics, mathematics, English language arts, music, electrical engineering

Growth as fast as average for the next ten years  
Source: Occupational Outlook Handbook

Chapter 9 Communication Systems 203

## Assessment

Assessment is an important part of learning. Knowing what you have learned is a good way to find out what you need to study.

## Section Assessment

Each section ends with a review and two academic activities.

### After You Read: Self-Check

Check your comprehension with vocabulary and concept questions. Connect content to academics with Academic Skills questions.

SECTION 9.1
ASSESSMENT

**Self-Check**

- Name the factors involved in message design.
- List the six purposes of a message.
- Define telecommunication.

**Think**

- Explain why smoke signals would be classified as a form of telecommunication.

**Practice Academic Skills**

**English Language Arts/Writing**

- Until the late 1950s, many people shared telephone lines, or party lines. Only one party could use the phone at a time, because you might hear another person talking. Write a paragraph comparing today's social networking technologies to ones your parents used at your age.

**Mathematics**

- Shanda wants to create an Internet ad for China and Thailand and has to calculate the combined population of the two countries. If China has 1,306 billion people and Thailand has 65 million, what is the total population?

**Representing Large Numbers** When you add larger numbers, make sure that they are expressed in the same form.

- Express the number for China's population, 1,306 billion, as 1,306 million.
- Add 1,306 million to 65 million to find the total combined population.

For help, go to [glencoe.com](http://glencoe.com) to this book's OLC and find the Math Handbook.

## Chapter Review and Assessment

The Chapter Review and Assessment contains a variety of review questions and activities.

**Chapter Summary** These summaries restate the main concepts of each section.

**Real-World Skills** STEM-based technology and real-world activities give you the chance to practice your skills and apply what you have learned.

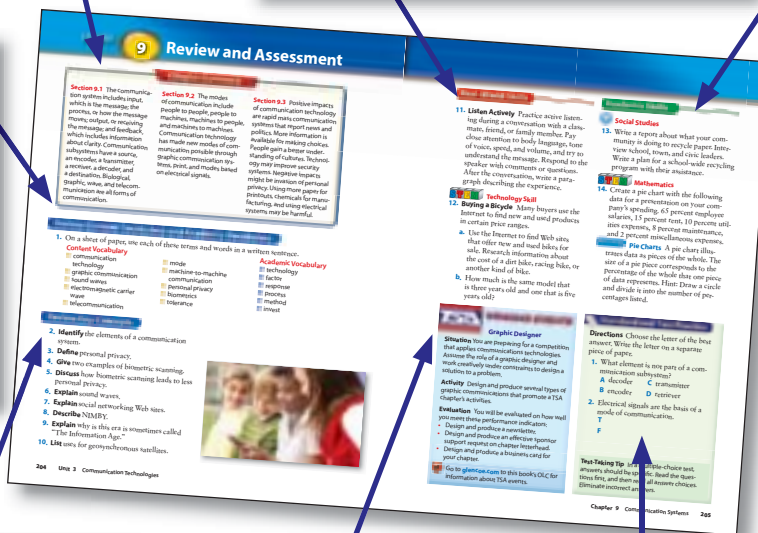
**Academic Skills** These activities connect STEM-based mathematics and science as well as English language arts and social studies with technology concepts. **Math Concept** shows ways to solve the mathematics problems.

**Review Vocabulary** The activity focuses on technology terms and words you should know for reading and tests.

**Review Key Concept** Practice your skills and reinforce your understanding of key concepts in the chapter.

**TSA Winning Events** Prepare for competitive events as you role-play situations from real TSA events.

**Standardized Test Practice** Prepare for standardized tests through multiple-choice and true/false questions. The **Test-Taking Tip** gives you advice on taking tests.



# Competitive Events

## Learn, Compete, Innovate!




### TSA and Competitive Events

The Technology Student Association (TSA) promotes personal growth, leadership, and opportunities in technology, innovation, design, and engineering. TSA members use and apply science, technology, engineering, and mathematics concepts by participating in co-curricular activities, competitive events, and related programs.

### TSA Winning Events

Participating in TSA and other competitive events is a fun way to apply and test your technology knowledge. Get to know other students as you work on exciting technology projects. Use the role-play exercise at the end of each chapter to increase your competitive advantage.

For more information about TSA competitive events, visit [www.tsaweb.org](http://www.tsaweb.org).


**WINNING EVENTS**  
**Graphic Designer**

**Situation** You are preparing for a competition that applies communications technologies. Assume the role of a graphic designer and work creatively under constraints to design a solution to a problem.

**Activity** Design and produce several types of graphic communications that promote a TSA chapter's activities.

**Evaluation** You will be evaluated on how well you meet these performance indicators:

- Design and produce a newsletter.
- Design and produce an effective sponsor support request on chapter letterhead.
- Design and produce a business card for your chapter.

 Go to [glencoe.com](http://glencoe.com) to this book's OLC for information about TSA events.

## What If English Is Not Your First Language?

### The English Language Learner

Today's classrooms offer terrific opportunities to learn many skills, including language skills. You might be a part of a classroom in which ten or more countries are represented. You and your classmates may actually speak different native languages. You can use this multicultural environment to practice speaking, writing, and listening skills. Practicing these skills with your teacher and your classmates will help you to communicate effectively in your other classes and in your future career.

#### Highlight Vocabulary

Check the section *Reading Guide* for vocabulary words that are not familiar. Write down these words and look them up in the glossaries at the back of the book.

**9.1 Introducing Communication Technology**

**Content Vocabulary**

- communication technology
- graphic communication
- sound waves
- electromagnetic carrier wave
- telecommunication

**Academic Vocabulary**

You will use these words in your reading and on your tests. Find their meanings at the back of this book.

**TECHNOLOGY STANDARDS**

**STL 2** Core Concepts of Technology

**STL 17** Information & Communication Technologies

**LEARNING STANDARDS**

**English Language Arts**

**NCE 4** Use written language to communicate effectively.

**NCE 12** Use language to accomplish individual purposes.

**Communication and Technology**

**3 Thematic Project**

**Shopping Online or In-Store**

**Your Project**

- Choose the store you represent.
- Choose and complete one task.
- Design an e-commerce Web site that allows customers to order and pay for goods on the site.
- Design an informational Web site without a commerce feature.
- Write a report.
- Create a presentation with posters or presentation software.
- Present your findings to the class.

**Tools and Materials**

- Computer
- Internet access
- Navigator
- Consumer magazines
- Word processing software
- Presentation software
- Posterboard
- Colored markers

**The Academic Skills You'll Use**

- Speak clearly and concisely.
- Communicate effectively.
- Communicate reading and grammar when taking notes or writing presentations.
- Think about how businesses get their products to their customers.

#### Learn through Pictures

Look at the photos and figures carefully. Make a connection between what you have seen in the real world and what you see in the picture. If something is not familiar, ask your teacher or a classmate to explain it.

**9 Review and Assessment**

**Section 9.1** The communication system involves people, a message, the process of the message, the medium, the receiver, the message, and feedback. Communication technology includes information about parts of communication systems, such as a receiver, a decoder, and a transmitter. Biological, linguistic, and telecommunication are all forms of communication.

**Section 9.2** The modes of communication include people-to-people, people-to-machine, machine-to-people, and machine-to-machine. Communication technology has made new modes of communication possible through graphic communication systems, print, and modes based on electrical signals.

**Section 9.3** Positive impacts of communication technology are rapid mass communication and access to information. People can be more productive and efficient. Technology may increase security. Negative impacts of technology include more paper for printing, chemical waste, and using electrical systems may be harmful.

**Academic Vocabulary**

- technology
- factor
- response
- method
- device
- device

**Tasks**

- On a sheet of paper, use each of these terms and words in a written sentence.
- Identify the elements of a communication system.
- Define personal privacy.
- Give two examples of biometric scanning.
- Discuss how biometric scanning leads to less personal privacy.
- Explain sound waves.
- Explain social networking. Web sites.
- Explain the NIMBY.
- Explain why a Web site is sometimes called "The Information Age."
- List uses for geosynchronous satellites.

**Practice Communication** Study with a classmate. At the end of each chapter, review the chapter together. Start by choosing two vocabulary words from the list. Take turns defining them. Who can find the words in the chapter?

**Connect to Your World** Show what you have learned by doing projects like the *Technology Lab* or the *Unit Thematic Project*. When you must choose a topic, think of your culture, experiences, and skills. Then select a topic that interests you. Relate your project to your world!

**9 Create an Ad**

**Tools and Materials**

- Markers, pens, pencils
- Posterboard
- Scissors
- Glue
- Magazines, books
- Computer and printer
- Presentation software
- Graphics software
- Scanner
- Copy machine
- Video camera

**Create an Ad**

For any intention to become important, people must know about it. They must also be convinced that they need it. If you wanted to sell everyone about a new invention, what mass communication system would you use? In this lab, you will get the chance to design an ad using the communication system of your choice.

**Learning Objectives**

Now you are going to create an advertisement for a brand new communication device. Some examples might include a PDA, a mobile TV, a laptop, or a new video game. You can also invent your own futuristic device for your class.

**Know the Culture and Conventions**

In this lab, you will:

- Work in a group of two to three, but no more than five people.
- Create an interesting print ad, a Web page, a PowerPoint presentation, or a short video advertisement.
- Design an ad that is:
  - attractive to your class
  - clear
  - easy to understand
  - attractive to your class
  - attractive to your class
  - attractive to your class
  - attractive to your class
- Why is it important to the development of technology?

**Academic Skills Required to Complete Lab**

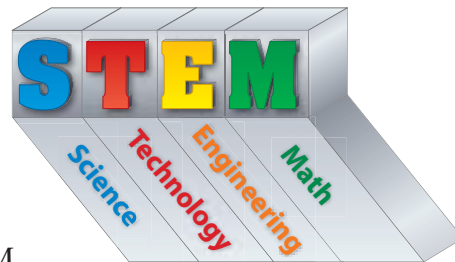
Tasks	English Language Arts	Math	Science	Social Studies
Research and use information from various sources.	✓			
Use appropriate technology.	✓			
Communicate effectively.	✓			
Present the data.	✓			

# Reach for Excellence in Math, Science, and Technology

## Welcome to the World of Engineering

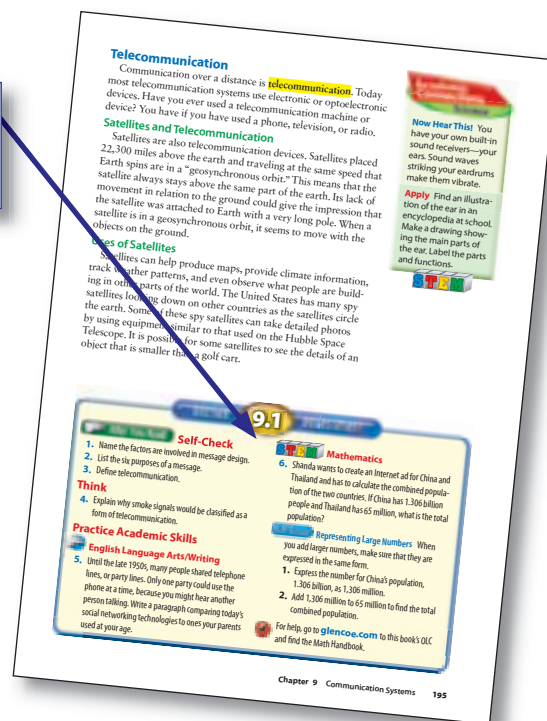
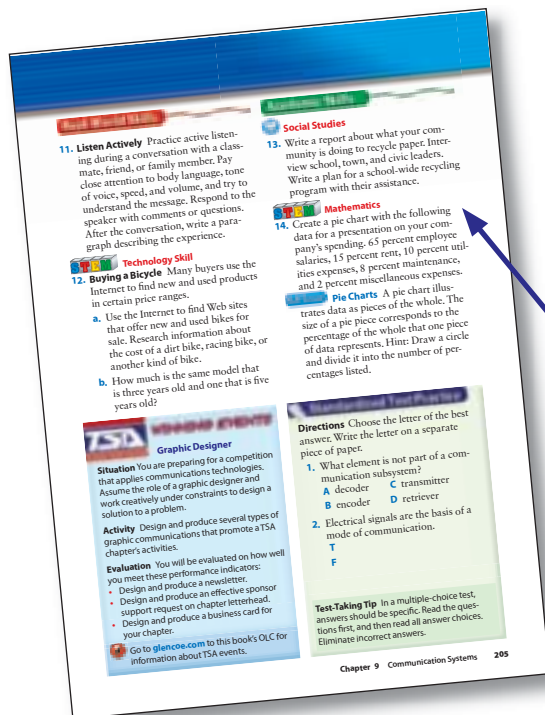
Important organizations like NASA, the space agency, and the National Science Foundation helped launch STEM learning. STEM stands for Science, Technology, Engineering, and Mathematics. STEM is also a nationwide initiative, or plan, developed for students just like you. STEM promotes learning those subjects to prepare you for success in tomorrow's world. Studying STEM subjects can lead you to exciting careers. In fact, STEM applies to most career fields today—from aircraft engineers, forensic scientists, and architects to firefighters, game developers, and auto mechanics.

In this book, you will find many Science, Technology, Engineering, and Mathematics activities in every chapter.



### STEM in Section Assessments

Jumpstart your STEM know-how with quick Section Assessments.



### STEM at the End of Each Chapter

Practice what you have learned in Science, Technology, Engineering, or Math through STEM activities at the end of the chapter.

For more information about STEM and exciting STEM careers, visit [www.stemedcoalition.org](http://www.stemedcoalition.org).

## What Are Standards?

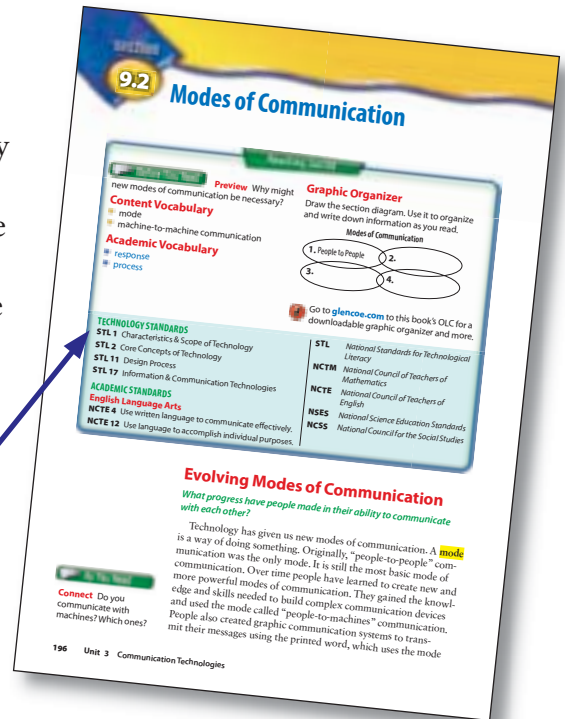
### Standards for Learning

*Introduction to Technology* was written to meet technology standards, so you will have a better understanding of technology and its impact on our world.

### Technology Standards

Each year we depend more and more on technology. For that reason, understanding technology is very important for everyone. Years ago the International Technology Education Association (ITEA) created the Technology for All Americans Project. This project developed standards for what students should be able to do and know to be technologically literate. These standards are called “Standards for Technological Literacy” (STL). They are also called “Technology Content Standards.”

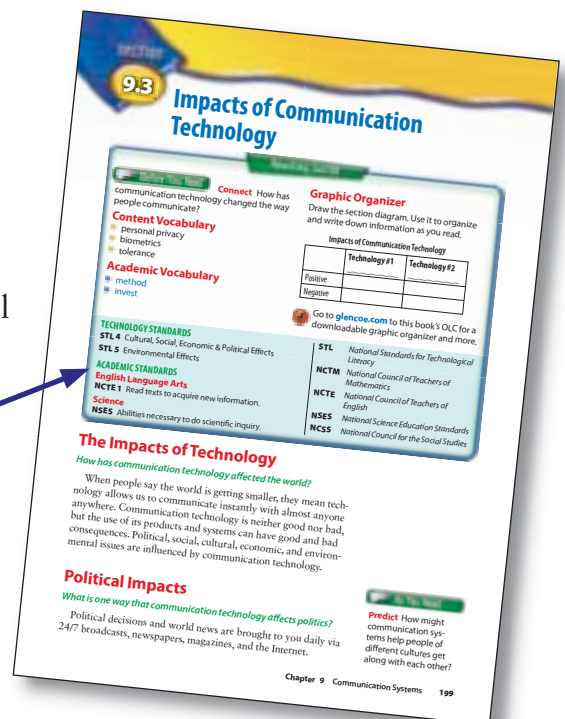
**Technology Standards** Each chapter of this book is divided into sections. In the Reading Guide, there is a list of the STLs covered in that section.



### Academic Standards

The English Language Arts, Mathematics, Science, and Social Studies standards are listed under the “Academic Standards” in the Reading Guide. You will practice these academic skills as you move through the chapter.

**Academic Standards** The Reading Guide provides a list of the Academic Standards covered in that section.



# Online Learning Center

## How to Access the OLC Student Center

Follow these steps to get to all the textbook resources at the *Introduction to Technology* Online Learning Center.

**Step 1**  
Go to [glencoe.com](http://glencoe.com).

**Step 2**  
Select your state from the pull-down menu.

**Step 3**  
Select Student.

**Step 4**  
Scroll through the subject menu to select Technology Education.

**Step 5**  
Click ENTER.

**Step 6**  
Select *Introduction to Technology* ©2010.

**Step 7**  
Click Student Center for a variety of classroom resources.





# Treasure Hunt

*Introduction to Technology* contains a wealth of information. Knowing where to find information in your textbook will help you get the most out of your study time. Come on, let's discover your textbook!



1 How many chapters are in the book? How many units?

2 What part of the textbook will show you where printing is taught?

3 Where do you find the WebQuest Internet Project?

4 What topic is featured in the Unit 3 Technology Time Machine?

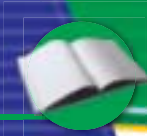
5 If you need help with one of the math applications, where would you look?

6 Where can you find the definitions of *gravure printing* and *hardware*?

7 What skill do you practice in Chapter 10, Section 10.2 Assessment?

8 Where do you find a Unit Thematic Project?





## ▶ Reading: What's in It for You?

What role does reading play in your life? The possibilities are countless. Are you on a sports team? Perhaps you like to read about the latest news and sports. Are you enrolled in an English class, an algebra class, or a science or technology class? Then your assignments require a lot of reading.

### *Improving or Fine-Tuning Your Reading Skills Will:*

- ◆ Improve your grades
- ◆ Allow you to read faster and more efficiently
- ◆ Improve your study skills
- ◆ Help you remember more information accurately
- ◆ Improve your writing

## ▶ The Reading Process

Good reading skills build on one another, overlap, and spiral around in much the same way that a winding staircase goes around and around while leading you to a higher place. This handbook is designed to help you find and use the tools you will need **before**, **during**, and **after** reading.

### *Strategies You Can Use*

- ◆ Identify, understand, and learn new words.
- ◆ Understand why you read.
- ◆ Take a quick look at the whole text.
- ◆ Try to predict what you are about to read.
- ◆ Take breaks while you read and ask yourself questions about the text.
- ◆ Take notes.
- ◆ Keep thinking about what will come next.
- ◆ Summarize.

## ▶ Vocabulary Development

Word identification and vocabulary skills are the building blocks of the reading and the writing process. By learning to use a variety of strategies to build your word skills and vocabulary, you will become a stronger reader.

### **Use Context to Determine Meaning**

The best way to expand and extend your vocabulary is to read widely, listen carefully, and participate in a rich variety of discussions. When reading on your own, though, you can often figure out the meanings of new words by looking at their **context**, the other words and sentences that surround them.



# Reading Skills Handbook

## Tips for Using Context

**Look for clues such as:**

A synonym or an explanation of the unknown word in the sentence:

*Elise's shop specialized in millinery, or hats for women.*

A reference to what the word is or is not like:

*An archaeologist, like a historian, deals with the past.*

A general topic associated with the word:

*The cooking teacher discussed the best way to braise meat.*

A description or action associated with the word:

*He used the shovel to dig up the garden.*

## Predict a Possible Meaning

Another way to find the meaning of a word is to take the word apart. If you understand the meaning of the **base**, or **root**, part of a word, and also know the meanings of key syllables added either to the beginning or end of the base word, then you can usually figure out what the word means.

**Word Origins** Since Latin, Greek, and Anglo-Saxon roots are the basis for much of our English vocabulary, having some background in languages can be a useful vocabulary tool. For example, *astronomy* comes from the Greek root *astro*, which means “relating to the stars.” *Stellar* also refers to stars, but its origin is Latin. Knowing root words in other languages can help you determine meanings, derivations, and spellings in English.

**Prefixes and Suffixes** A prefix is a word part that can be added to the beginning of a word. For example, the prefix *semi* means “half” or “partial,” so *semicircle* means “half a circle.” A suffix is a word part added to the end of a word. Adding a suffix can change a word’s part of speech.

**Using Dictionaries** A dictionary provides the meaning or meanings of a word. Look at a dictionary entry to see what other information it provides.

**Thesauruses and Specialized Reference Books** A thesaurus provides synonyms and often antonyms. A synonym is a word that means the same thing as the word you are using. Check the exact definition of the listed words in a print or online dictionary before you use a thesaurus.

**Glossaries** Many textbooks contain condensed dictionaries that provide an alphabetical listing of words used in the text and their definitions.

**Recognize Word Meanings across Subjects** Have you learned a new word in one class, and then noticed it in your reading for other subjects? The word might not mean exactly the same thing in each class, but you can use the meaning you already know to help you understand what it means in another subject area. For example:

**Math** After multiplying the two numbers, explain how you found the **product**.

**Science** One **product** of photosynthesis is oxygen.

**Economics** The Gross National **Product (GNP)** is the total dollar value of goods and services produced by a nation.



## ► Understanding What You Read

Reading comprehension means understanding—deriving meaning from—what you have read. Using a variety of strategies can help you improve your comprehension and make reading more interesting and more fun.

### Read for a Reason

To get the greatest benefit from what you read, you should **establish a purpose for reading**. In school, you have many reasons for reading. Some of them are:

- To learn and understand new information
- To find specific information
- To review before a test
- To complete an assignment
- To prepare (research) before you write

As your reading skills improve, you will notice that you apply different strategies to fit the different purposes for reading. For example, if you are reading for entertainment, you might read quickly, but if you read to gather information or follow directions, you might read more slowly, take notes, construct a graphic organizer, or reread sections of text.

### Draw on Personal Background

Drawing on personal background may also be called activating prior knowledge. Before you start reading a text, ask yourself questions like these:

- What have I heard or read about this topic?
- Do I have any personal experience relating to this topic?

**Using a KWL Chart** A KWL chart is a good device for organizing information you gather before, during, and after reading. In the first column, list what you already **know**, then list what you **want** to know in the middle column. Use the third column when you review and you assess what you **learned**. You can also add more columns to record places where you found information and places where you can look for more information.

K (What I already know)	W (What I want to know)	L (What I have learned)

**Adjust Your Reading Speed** Your reading speed is a key factor in how well you understand what you are reading. You will need to adjust your speed depending on your reading purpose.

**Scanning** means running your eyes quickly over the material to look for words or phrases. Scan when you need a specific piece of information.

**Skimming** means reading a passage quickly to find its main idea or to get an overview. Skim a text when you preview to determine what the material is about.



**Reading for detail** involves careful reading while paying attention to text structure and monitoring your understanding. Read for detail when you are learning concepts, following complicated directions, or preparing to analyze a text.

## ► Techniques to Understand and Remember What You Read

### Preview

Before beginning a selection, it is helpful to **preview** what you are about to read.

#### Previewing Strategies

- ◆ Read the title, headings, and subheadings of the selection.
- ◆ Look at the illustrations and notice how the text is organized.
- ◆ Skim the selection: Take a glance at the whole thing.
- ◆ Decide what the main idea might be.
- ◆ Predict what a selection will be about.

### Predict

Have you ever read a mystery, decided who committed the crime, and then changed your mind as more clues were revealed? You were adjusting your predictions. Did you smile when you found out you guessed the murderer? You were verifying your predictions.

As you read, take educated guesses about story events and outcomes; that is, **make predictions** before and during reading. This will help you focus your attention on the text, and it will improve your understanding.

### Determine the Main Idea

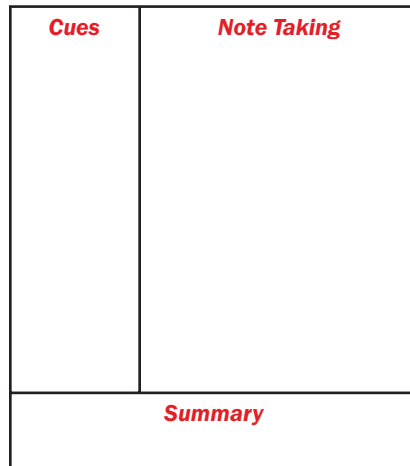
When you look for the **main idea**, you are looking for the most important statement in a text. Depending on what kind of text you are reading, the main idea can be located at the very beginning (news stories in newspaper or a magazine) or at the end (scientific research document). Ask yourself:

- What is each sentence about?
- Is there one sentence that is more important than all the others?
- What idea do details support or point out?



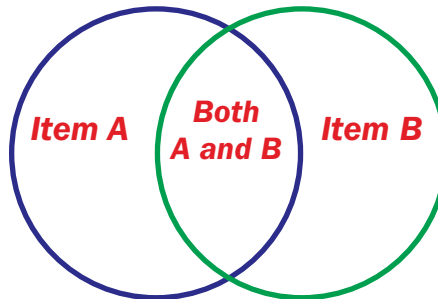
## Taking Notes

**Cornell Note-Taking System** There are many methods for note taking. The **Cornell Note-Taking System** is a well-known method that can help you organize what you read. To the right is a note-taking chart based on the Cornell Note-Taking System.

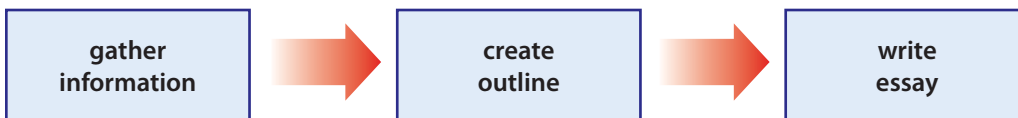


**Graphic organizers** Using a graphic organizer to retell content in a visual representation will help you remember and retain content. You might make a **chart** or **diagram**, organizing what you have read. Here are some examples of graphic organizers:

**Venn diagrams:** When mapping out a comparison-and-contrast text structure, you can use a Venn diagram. The outer portions of the circles will show how two characters, ideas, or items contrast, or are different, and the overlapping part will compare two things, or show how they are similar.



**Flow charts:** To help you track the sequence of events, or cause and effect, use a flow chart. Arrange ideas or events in their logical, sequential order. Then draw arrows between your ideas to indicate how one idea or event flows into another.



## Visualize

Try to form a mental picture of scenes, characters, and events as you read. Use the details and descriptions the author gives you. If you can **visualize** what you read, it will be more interesting, and you will remember it better.

## Question

Ask yourself questions about the text while you read. Ask yourself about the importance of the sentences, how they relate to one another, if you understand what you just read, and what you think is going to come next.



## Clarify

If you feel you do not understand meaning (through questioning), try these techniques:

### *What to Do When You Do Not Understand*

- ◆ Reread confusing parts of the text.
- ◆ Diagram (chart) relationships between chunks of text, ideas, and sentences.
- ◆ Look up unfamiliar words.
- ◆ Talk out the text to yourself.
- ◆ Read the passage once more.

## Review

Take time to stop and review what you have read. Use your note-taking tools (graphic organizers or Cornell notes charts). Also, review and consider your KWL chart.

## Monitor Your Comprehension

Continue to check your understanding by using the following two strategies:

**Summarize** Pause and tell yourself the main ideas of the text and the key supporting details. Try to answer the following questions: Who? What? When? Where? Why? How?

**Paraphrase** Pause, close the book, and try to retell what you have just read in your own words. It might help to pretend you are explaining the text to someone who has not read it and does not know the material.

## ► Understanding Text Structure

Good writers do not just put together sentences and paragraphs, they organize their writing with a specific purpose in mind. That organization is called “text structure.” When you understand and follow the structure of a text, it is easier to remember the information you are reading. There are many ways text may be structured. Watch for **signal words**. They will help you follow the text’s organization (also, remember to use these techniques when you write).

## Compare and Contrast

This structure shows similarities and differences between people, things, and ideas. This is often used to demonstrate that things that seem alike are really different, or vice versa.

**Signal words:** similarly, more, less, on the one hand / on the other hand, in contrast, but, however



## Cause and Effect

Writers used the cause and effect structure to explore the reasons for something happening and to examine the results or consequences of events.

**Signal words:** so, because, as a result, therefore, for the following reasons

## Problem and Solution

When writers organize text around the question “how?” they state a problem and suggest solutions.

**Signal words:** how, help, problem, obstruction, overcome, difficulty, need, attempt, have to, must

## Sequence

Sequencing tells you the order in which to consider thoughts or facts. Examples of sequencing are:

**Chronological order** refers to the order in which events take place.

**Signal words:** first, next, then, finally

**Spatial order** describes the organization of things in space (to describe a room, for example).

**Signal words:** above, below, behind, next to

**Order of importance** lists things or thoughts from the most important to the least important (or the other way around).

**Signal words:** principal, central, main, important, fundamental

## ▶ Reading for Meaning

It is important to think about what you are reading to get the most information out of a text, to understand the consequences of what the text says, to remember the content, and to form your own opinion about what the content means.

### Interpret

Interpreting is asking yourself, “What is the writer really saying?” and then using what you already know to answer that question.

### Infer

Writers do not always state exactly everything they want you to understand. By providing clues and details, they sometimes imply certain information. An **inference** involves using your reason and experience to develop the idea on your own, based on what an author implies or suggests. What is most important when drawing inferences is to be sure that you have accurately based your guesses on supporting details from the text. If you cannot point to a place in the selection to help back up your inference, you may need to rethink your guess.





## Draw Conclusions

A conclusion is a general statement you can make and explain with reasoning or with supporting details from a text. If you read a story describing a sport in which five players bounce a ball and throw it through a high hoop, you may conclude that the sport is basketball.

## Analyze

To understand persuasive nonfiction (a text that discusses facts and opinions to arrive at a conclusion), you need to analyze statements and examples to see if they support the main idea. To understand an informational text (a text, such as a textbook, that gives you information, not opinions), you need to keep track of how the ideas are organized to find the main points.

**Hint:** Use your graphic organizers and notes charts.

## Distinguish Facts and Opinions

This is one of the most important reading skills you can learn. A fact is a statement that can be proven. An opinion is what the writer believes. A writer may support opinions with facts, but an opinion cannot be proven. For example:

**Fact:** California produces fruit and other agricultural products.

**Opinion:** California produces the best fruit and other agricultural products.

## Evaluate

Would you take seriously an article on nuclear fission if you knew it was written by a comedic actor? If you need to rely on accurate information, you need to find out who wrote what you are reading and why. Where did the writer get information? Is the information one-sided? Can you verify the information?

## ▶ Reading for Research

You will need to **read actively** in order to research a topic. You might also need to generate an interesting, relevant, and researchable **question** on your own and locate appropriate print and nonprint information from a wide variety of sources. Then you will need to **categorize** that information, evaluate it, and **organize** it in a new way in order to produce a research project for a specific audience. Finally, **draw conclusions** about your original research question. These conclusions may lead you to other areas for further inquiry.