

Breakthrough Inventions

A Closer Look at Inventions That Changed Our World

Inventions such as the electric light, the automobile, the telephone, radio, television, and the computer have radically transformed the world. Although it is easy to take them for granted, modern society is highly dependent on these machines.

Consequently, students are curious about where these machines came from, how they work, and how they have changed the world. The *Breakthrough Inventions* Teacher Guide serves to fuel further exploration of inventions that have led to dramatic social change. By using this guide, you have an opportunity to tap into student interest while exposing students to broader scientific and social issues.

Participation in these lessons will lead students to make global connections and understand higher level concepts, such as communication, technical design, and the social impact of scientific developments. Students will become aware of some of the issues involved in communications, transportation, and access to technology. They will realize that inventions and other advances in science and technology have positive and negative effects.

The lesson plans in this guide are tailored for grades 4–6 and address various subjects, such as science, social studies, language arts, mathematics, and art. Each lesson plan is designed to stand alone. As such, they do not need to be presented in sequential order. Helpful reproducible worksheets and rubrics appear at the end of the guide. The book titles referenced in this guide include:

Inventing the Automobile

Inventing the Printing Press

Inventing the Camera

Inventing the Radio

Inventing the Computer

Inventing the Telephone

Inventing the Electric Light

Inventing the Television

As students investigate the topics addressed in the guide and become more aware of inventions and their impact, they will sharpen their critical thinking skills to work towards creative solutions to worldwide problems. We invite you to jump in and ask questions with your class as you have fun learning more about inventions that changed our world.



National Standards Correlation

Lesson Plan Title	Correlation to National Standards
<p>Cars of the Future</p>	<p>Language Arts Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.</p> <p>Science Students should develop understanding of risks and benefits. Students should develop understanding of science and technology in society.</p> <p>Social Studies The learner can suggest ways to monitor science and technology in order to protect the physical environment, individual rights, and the common good.</p>
<p>Homemade Cameras</p>	<p>Mathematics Students should use visualization, spatial reasoning, and geometric modeling to solve problems. Students should apply appropriate techniques, tools, and formulas to determine measurements.</p> <p>Science Students should develop abilities of technological design. Students should develop understandings about science and technology.</p>
<p>Computers Hiding in Plain Sight</p>	<p>Science Students should develop abilities necessary to do scientific inquiry. Students should develop understandings about science and technology. Students should develop understanding of science and technology in society.</p> <p>Social Studies The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.</p>
<p>Lighting Smart</p>	<p>Language Arts Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.</p> <p>Math Students should compute fluently and make reasonable estimates.</p> <p>Science Students should develop understandings about science and technology. Students should develop understanding of science and technology in society.</p>

Lesson Plan Title	Correlation to National Standards
<p>Printing the News</p>	<p>Language Arts Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works. Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.</p> <p>Science Students should develop abilities of technological design.</p>
<p>Radio Then and Now</p>	<p>Language Arts Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.</p> <p>Science Students should develop understanding of science and technology in society.</p> <p>Social Studies The learner can describe ways in which language, stories, folktales, music, and artistic creations serve as expressions of culture and influence behavior of people living in a particular culture. The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.</p>
<p>No Phone Emergency!</p>	<p>Language Arts Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).</p> <p>Math Students should solve problems that arise in mathematics and in other contexts.</p> <p>Science Students should develop understanding of science and technology in society.</p> <p>Social Studies The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.</p>
<p>The Next Big Thing in Television</p>	<p>Science Students should develop abilities of technological design. Students should develop understandings about science and technology. Students should develop understanding of science and technology in society.</p> <p>Social Studies The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.</p>

For state specific educational standards, please visit <http://www.crabtreebooks.com/>.

Overview and Scope of Lesson Plan Activities

Lesson Plan Title	Subject Areas	Major Concepts
Cars of the Future	Art Language Arts Science Social Studies Writing	<ul style="list-style-type: none"> • reducing environmental impact of automobiles • alternative fuels • persuasive writing • industrial design
Homemade Cameras	Art Mathematics Science	<ul style="list-style-type: none"> • basic principles of photography • constructing a simple camera • identifying camera parts and function
Computers Hiding in Plain Sight	Science Social Studies	<ul style="list-style-type: none"> • presence and versatility of computers and microprocessors • rapid development of computer technology • social effects of technology • scientific and critical inquiry
Lighting Smart	Language Arts Mathematics Science Writing	<ul style="list-style-type: none"> • energy-efficient lighting • comparing incandescent and compact fluorescent light bulbs • incandescent lighting • basic arithmetic • persuasive writing
Printing the News	Art Language Arts Mathematics Science Writing	<ul style="list-style-type: none"> • publishing and presenting • journalism • informative writing • history of printing • social effects of technology
Radio Then and Now	Language Arts Science Social Studies	<ul style="list-style-type: none"> • research and collecting information • critical listening • radio broadcasting in cultural history • comparing and contrasting
No Phone Emergency!	Language Arts Mathematics Performing Arts Science Social Studies	<ul style="list-style-type: none"> • nonverbal communication • developing a signal communication system • emergency communication • reliance on telecommunication technology
The Next Big Thing in Television	Art Science Social Studies	<ul style="list-style-type: none"> • uses of television technology • connecting technology with individual and social needs • television components and function • technological design

Pacing Chart and Vocabulary

One class period is approximately 40 minutes.

Lesson Plan Title	Pacing	Vocabulary	Assessment
Cars of the Future	1–2 class periods	alternative fuels benefits depletion of resources environmental impact hybrid engine pollution	Evaluate student posters, reproducibles, and performances for accuracy, creativity, and persuasiveness.
Homemade Cameras	2–3 class periods	aperture camera obscura lens photography pinhole camera	Assess reproducibles for accuracy and understanding. Monitor groups' success with pinhole cameras.
Computers Hiding in Plain Sight	1–2 class periods	ENIAC microprocessor versatility	Evaluate student reproducibles for accuracy and a wide range of items and devices.
Lighting Smart	2 class periods	compact fluorescent light bulbs energy efficiency filament incandescent light bulbs wattage	Assess students' reproducibles and presentations for accuracy, practicality, and persuasiveness.
Printing the News	2–3 class periods	journalism printing press	Have students trade newspapers with a partner and use the <i>Printing the News</i> rubric to evaluate their partner's article and advertisement.
Radio Then and Now	1 class period	AM and FM broadcasting commercial radio Golden Age of Radio popular culture	Evaluate student reproducibles for thoroughness and accuracy.
No Phone Emergency!	1–2 class periods	communication semaphore signal communication system telecommunications	Evaluate signal communication systems for comprehensiveness and ease of use. Evaluate student performances for effort and accurate communication.
The Next Big Thing in Television	1–2 class periods	cathode-ray tube interactive liquid-crystal display news and educational programming plasma videoconferencing	Evaluate student reproducibles and presentations for comprehensiveness. Student designs should be practical and address the concerns that viewers either have today or can be expected to have in the future.

Cars of the Future

A Lesson on Automobile Parts and Features

Content

Students will strengthen their understanding of automobile systems, safety features, and environmental impacts by creating and explaining their own automobile designs.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop understanding of risks and benefits.

Students should develop understanding of science and technology in society.

Social Studies

The learner can suggest ways to monitor science and technology in order to protect the physical environment, individual rights, and the common good.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Interpersonal



Logical-Mathematical



Linguistic



Visual-Spatial

Prerequisites

Students should read the book *Inventing the Automobile* to familiarize themselves with the different parts and systems that allow cars to run. Review with students the impacts of cars and the measures manufacturers have taken to improve safety and reduce fuel consumption and pollution.

Materials

- *Inventing the Automobile* books
- magazine or newspaper advertisements for cars
- poster board (one per group)
- markers
- construction paper
- scissors
- double-sided tape
- student copies of the *Cars of the Future* reproducible

Instructional Procedure

Anticipatory Set

To begin the lesson, distribute car advertisements from magazines or newspapers to students. Ask students to think about how they would choose a car if they were planning to purchase one. Ask: *What do you think is most important to look for in a car?* As students discuss how they would choose which car to purchase, encourage them to support the criteria they suggest.

Class Discussion

Write the words *Benefits* and *Problems* on the board, leaving room for a third heading. Review the sections of *Inventing the Automobile* that describe the impacts of cars, including pages 12–13, 22–23, and 28–29. Ask: *What are some of the benefits of cars?* Students may mention increased mobility, new industries, economic growth, increased availability of goods, and faster emergency services. Write student responses on the board. Ask: *What are some of the problems cars cause?* Students should mention safety hazards, pollution, and depletion of resources. Again, write student responses on the board.

Next, write the word *Solutions* on the board. Ask: *How can we solve the problems cars cause?* Encourage students to refer to their books as they discuss possible solutions. Write student suggestions on the board. Tell students they will use some of their solutions to design new cars.

Objective

The student will be able to...

- recognize the benefits and the costs of automobiles
- evaluate solutions to the problems caused by automobiles
- identify important components of automobiles
- write persuasively about automobiles

Activity

Divide students into small groups and distribute the poster board, markers, construction paper, scissors, double-sided tape, and student copies of the *Cars of the Future* reproducible. Explain to students that they will design a car of the future that will help solve some of the problems caused by cars today. Students will also create advertisements that persuade people to buy and drive their cars.

Have students follow these steps to design their cars:

1. Use markers to draw the car body on the poster board. Tell students to base their drawings on the illustrations on pages 20–21 and 30–31 of *Inventing the Automobile*, as well as the advertisements from the anticipatory set.
2. Use the construction paper and scissors to make paper arrows. Use the markers to label the arrows with the following car parts: *regular engine, diesel engine, hybrid engine, electric engine, automatic transmission, manual transmission, regular fuel system, biodiesel fuel system, battery/fuel-cell fuel system, steel body, aluminum body, fiberglass body suspension system, and crumple zone.*
3. Choose parts from the arrows to include in their cars. Students should reread the pages about the different types of engines, fuel systems, and bodies cars can have. Remind students to think about the benefits and limitations of each choice.
4. Tape the selected paper arrows onto the poster board, referring to the diagram on pages 20–21. Students may draw and write additional features on the poster board as well.
5. Write the name of their car on the poster board.

Have students write advertisements for their cars by completing the reproducible. Tell students to fill in the name of their car and identify the parts they have included. Then, students should explain the benefits of each part on the lines provided. Remind students that their goal is to persuade people to buy their car.

Accommodations and Extensions

Help students review the various engine and fuel options to help them choose which ones to put in their cars. Remind students to think about which ones would best benefit the environment and minimize pollution.

As an extension, have students research scientific developments in alternative fuels, such as batteries and hydrogen fuel cells.

Closure

Have students present their posters and read their advertisements to the class. Then, discuss the strengths of each design. You may want to have the class vote for one car of the future.

Assessment

Evaluate student posters, reproducibles, and performances for accuracy, creativity, and persuasiveness.

Homemade Cameras

A Lesson Exploring Basic Camera Functions

Content

Students will identify the parts of the camera described in *Inventing the Camera* and demonstrate their understanding of how the parts function. They will then deepen their understanding of the basic principles of cameras by constructing and using simple pinhole cameras.

National Standards

The following standards will be addressed in the lesson:

Mathematics

Students should use visualization, spatial reasoning, and geometric modeling to solve problems.

Students should apply appropriate techniques, tools, and formulas to determine measurements.

Science

Students should develop abilities of technological design.

Students should develop understandings about science and technology.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Interpersonal



Logical-Mathematical



Naturalistic



Visual-Spatial

Prerequisites

Have students read the book *Inventing the Camera* before proceeding with the lesson. Review with students how cameras use light and film to capture images.

Materials

- *Inventing the Camera* books
- student copies of the *Homemade Cameras* reproducible
- empty cardboard oatmeal containers, or other cardboard cylinders with cardboard bottoms (one per group)
- black construction paper
- tape or glue
- sewing needles or push-pins
- transparent plastic sheets
- pencils
- scissors
- craft stems or pipe cleaners

Instructional Procedure

Anticipatory Set

Ask students if they have cameras of their own, or if they have ever used cameras. Encourage students to describe the cameras they have used and identify if they are digital or use film. Ask: *What did you learn about the history of cameras from reading the book Inventing the Camera? What did you find surprising about early cameras?*

Class Discussion

Distribute student copies of the *Homemade Cameras* reproducible. Have students complete the reproducibles by explaining the function of the essential parts of a camera. Write the words *Aperture*, *Lens*, *Camera Body*, *Viewfinder*, and *Film* on the board. Then, ask students to share their responses from the reproducible. Write student explanations of each part on the board.

Ask: *Which of these are the basic parts a camera needs to have?* If students are uncertain, point out that the earliest camera, the *camera obscura*, was a darkened room or box with a tiny hole to let in light. Guide students to recognize that the essential elements of a camera are the camera body and the aperture. Then, tell students that they are going to make very simple cameras called *pinhole cameras*. Point out that their pinhole cameras will only have bodies and apertures, but some pinhole cameras can take pictures with film.

Objectives

The student will be able to...

- identify the main parts of a camera
- locate important information in the text
- construct simple cameras and understand how they work
- work collaboratively in small groups

Activity

Divide students into small groups and tell them that they will construct simple cameras. Distribute the oatmeal containers (one per group), black construction paper, tape or glue, sewing needles or push-pins, plastic sheets, pencils, scissors, and craft stems or pipe cleaners. Have students follow these directions to make their pinhole cameras:

1. Use black construction paper and tape or glue to line the insides of the container.
2. Use a needle or push-pin to make a single pinhole in the center of the container's bottom.
3. Place the plastic sheet over the open end of the container, trace a circle that will fit inside the container, and cut out the circle with scissors.
4. Attach a craft stem or pipe cleaner to the edge of the plastic circle with tape or glue.
5. Slide the plastic into the container with the craft stem or pipe cleaner on the open end.

Take students outside on a bright, sunny day. Have them point the bottoms of the containers at objects such as plants or playground equipment, and look into the open end. Students should see an image of the object or objects upside-down and reversed on the plastic sheet. Have students focus by moving the plastic sheet closer or farther from the pinhole, using the craft stem or pipe cleaner.

Accommodations and Extensions

Explain to students that the pinhole is the aperture of the camera. Light enters the camera through the pinhole and creates an image on the plastic circle. Help students identify the camera parts on pages 22–23 of *Inventing the Camera* that their pinhole cameras do not have.

As an extension, have students research pinhole cameras. Help students add shutters and viewfinders to their cameras and take pinhole photographs using photographic paper or film.

Closure

Explain to students that pinhole cameras can be loaded with film or with photographic paper and can take photographs. Tell students that some photographers choose to use pinhole cameras instead of modern film or digital cameras. Ask: *What would be the advantages and disadvantages of using a pinhole camera?* (Advantages include the simplicity and affordability of pinhole cameras. Disadvantages include limited ability to focus and control exposures.)

Assessment

Assess reproducibles for accuracy and understanding. Monitor groups' success with pinhole cameras.

Computers Hiding in Plain Sight

A Lesson on Computers in Everyday Products

Content

Students will learn about the presence of computers and microprocessors in everyday life.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop abilities necessary to do scientific inquiry.

Students should develop understandings about science and technology.

Students should develop understanding of science and technology in society.

Social Studies

The learner can identify and describe examples in which science and technology have changed the lives of people, such as in home-making, childcare, work, transportation, and communication.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Bodily-Kinesthetic



Logical-Mathematical



Musical



Visual-Spatial

Prerequisites

Students should read the book *Inventing the Computer* to familiarize themselves with the history and common uses of computers. Review with students how modern electronic devices developed rapidly from the earliest electronic computers.

Materials

- *Inventing the Computer* books
- cell phone or portable music player, if available
- student copies of the *Computers Hiding in Plain Sight* reproducible

Instructional Procedure

Anticipatory Set

Ask: *What was the first electronic computer called? When was it invented?* Allow students time to scan through the book for the answer. (The ENIAC was the first electronic computer. It was invented in 1944.) Ask students to describe the ENIAC.

Students should mention its enormous size and lack of computing power relative to today's computers. Ask: *How have computers changed since then?* Students should note that computers have gotten smaller, more powerful, and more versatile.

Class Discussion

Ask students to raise their hands if they have ever used computers. Ask students what they have used computers to do, and write the responses on the board. Students may mention doing homework or research for school, sending email or instant messages to friends, playing games, and searching the Internet for information about favorite movies, television shows, or musicians. Point out that almost all of the responses on the board are functions of personal computers. Ask: *Are personal computers the only kind of computer we use today?* (No. We use computers in devices such as cell phones and portable music devices, among others.)

Objectives

The student will be able to...

- explain common uses of computers
- identify devices that use microprocessors
- evaluate the social impacts of computers and microprocessors
- recognize the presence of computers and microprocessors in their lives

Activity

Remind students that tiny computers called microprocessors can be found in many devices used today. Review pages 28–29 of *Inventing the Computer* with the class. Ask students if they have used any of the devices described in “Invisible Computers.” Students have likely used cell phones, portable music players, and other devices. You may want to display a cell phone or portable music player. Ask: *When you used these devices, did you realize you were using a computer?* (yes/no)

Distribute the *Computers Hiding in Plain Sight* reproducible and review the instructions with students. Tell students to look for hidden computers in each place they go during an average day. Students should think about how devices, such as cell phones, portable music players, and some toys, work. Students may want to visit manufacturers’ web sites to determine how devices use microprocessors. Give students one to two days to complete the chart on the reproducible.

Accommodations and Extensions

Students can work in pairs to look for devices with microprocessors in the school library. You may allow students an extra day to complete the chart.

As an extension, have students choose one common device that uses a microprocessor, such as an Automated Teller Machine (ATM), a cell phone, or a portable music player. Have students research how the device has impacted society.

Closure

Have students share their completed charts with the class. List the items or devices from students’ charts on the board. Encourage students to discuss how often people use and depend on computers today.

Assessment

Evaluate student reproducibles for accuracy and a wide variety of items and devices.

Lighting Smart

A Lesson on Using Electric Lights Efficiently

Content

Students will reinforce their understanding of how electric lights work and apply their knowledge to thinking about energy-efficient lighting.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Math

Students should compute fluently and make reasonable estimates.

Science

Students should develop understandings about science and technology.

Students should develop understanding of science and technology in society.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Logical-Mathematical



Linguistic



Visual-Spatial

Prerequisites

Students should read the book *Inventing the Electric Light* to gain an understanding of how incandescent light bulbs work. Students should also familiarize themselves with the concept of energy conservation.

Materials

- *Inventing the Electric Light* books
- 40, 60, 75, and 100 watt incandescent light bulbs
- compact fluorescent light bulbs of equivalent wattage
- fluorescent tube light bulbs, if available
- student copies of the *Lighting Smart* reproducible

Instructional Procedure

Anticipatory Set

Before class begins, draw a simple diagram of an incandescent light bulb on the board. Model your drawing on the illustration on page 23 of *Inventing the Electric Light*, making sure the filament is clearly visible.

To begin the lesson, point out the diagram on the board and have volunteers label the base, filament, and glass bulb. Remind students that the bulb is filled with an inert gas, which makes the light more efficient. Ask: *How does an incandescent light bulb produce light?* Student responses should focus on electricity passing through the filament, heating it, and causing it to *incandescence*, or glow. Tell students that the basic design of the incandescent bulb has changed little since it was invented by Joseph Swan and Thomas Edison.

Class Discussion

Show students 40, 60, 75, and 100 watt incandescent light bulbs. Ask: *What kind of light bulbs are these? How are they different from each other?* Students should recognize that these are incandescent bulbs, and should mention that the bulbs use different amounts of energy and give off different amounts of light. Next, show students compact fluorescent lights that provide light equal to that of the incandescent bulbs. If they are available, show students fluorescent tube light bulbs also. Ask: *What kind of light bulbs are these? How are they different from the incandescent bulbs?* Students should recognize that these are fluorescent bulbs, and should mention that they use less electricity than incandescent bulbs. Point out that the compact fluorescent bulbs can replace incandescent bulbs in standard electric light sockets.

Objectives

The student will be able to...

- identify the key parts of an incandescent light bulb
- recognize incandescent and compact fluorescent light bulbs
- understand basic aspects of energy efficiency
- write clearly and persuasively about energy-efficient lighting

Activity

Distribute student copies of the *Lighting Smart* reproducible and review the chart comparing the watts used by incandescent and compact fluorescent light bulbs. Tell students that they will use this information to create energy-efficient lighting plans for one room in the school or in their homes.

Have students choose rooms at school or at home where three or more electric lights are in use. For each light in the room, students should answer the following questions:

- How many bulbs does it use?
- What kind of bulbs (incandescent or fluorescent) does it use?
- What is the wattage of the bulbs?
- What is the total wattage of the light?

Tell students to enter this information in the chart on the reproducible.

Then, have students make a plan to reduce the energy used to light the room. Students' plans should combine removing some lights from the room and replacing some or all incandescent bulbs with compact fluorescent bulbs. Remind students that their plans should still light the room adequately. Students should use the chart on the reproducible to calculate how much energy, in watts, their plans would save. Finally, have students write a short passage to describe their plans and to persuade the school or their parents to make the changes they recommend.

Accommodations and Extensions

Have students work in mixed-ability pairs or small groups to draw posters encouraging energy efficiency rather than writing descriptions of their plans.

As an extension, have students research additional reductions in energy use and write a short paragraph summarizing their findings.

Closure

Have students present their plans and read their descriptions to the class. Then, lead a discussion of how future developments might improve efficiency. Encourage students to review pages 30–31 of *Inventing the Electric Light*. Ask: *What new idea do you think will do the most to make electric light more energy-efficient?* Students should mention more efficient electric light bulbs and LED lights, among others.

Assessment

Assess students' reproducibles and presentations for accuracy, practicality, and persuasiveness.

Printing the News

A Lesson on Newspaper Writing and Publishing

Content

Students will gain an understanding of newspaper publishing by producing a class newspaper.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Science

Students should develop abilities of technological design.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Linguistic



Visual-Spatial

Prerequisites

Students should read the book *Inventing the Printing Press* to learn about the history of the printing press. Students should also be familiar with newspaper journalism and advertisements.

Materials

- *Inventing the Printing Press* books
- copies of a local newspaper
- access to computers with word processing software, printers, and photocopiers
- scanner or digital camera (optional)
- paper (8½" x 11" and 11" x 17" sizes)
- colored pencils or markers

Instructional Procedure

Anticipatory Set

Before class begins, arrange for students to have access to computers with word processing software, printers, and photocopiers in the classroom, school library, or school computer lab.

Tell students that the printing press is considered one of the most important inventions of all time. Ask: *How did the printing press change the world?* Students should mention effects such as widespread literacy, the spread of information and ideas, and new kinds of entertainment and commerce. Students may also mention printed products they see every day, such as books, magazines, newspapers, catalogs, and paper money. Write student responses on the board.

Class Discussion

Remind students that printing presses are used to print more than 60,000 newspapers around the world today. Distribute copies of local newspapers to the class and allow students time to examine them. Ask students what they notice about the way the newspapers are made. Students may mention that they are made of large sheets of paper folded together, they are printed on both sides of the paper with greasy ink, and their pages are dense with text.

Objectives

The student will be able to...

- examine local newspapers
- write newspaper articles and create advertisements
- format and assemble documents

Activity

Part I: Planning the Paper

Tell the class they will work in groups to write and publish their own newspapers. Newspapers will be four pages long and focus on the following topics:

- Page 1: School news and events. This page will have one article and one advertisement.
- Page 2: Community news. This page will have one article and one advertisement.
- Page 3: Sports. This page will have one article and one advertisement.
- Page 4: Arts. This page will have one article or review and one advertisement.

Divide students into groups of four and assign one page to each student. Allow groups time to discuss the articles and advertisements they want to include on their pages, offering suggestions as needed. The Page 1 article can cover classes, school assemblies and programs, or similar topics. The Page 2 article can cover news and events from the community. The Page 3 article can cover professional, local, or school sports. Page 4 can include an article about school and local arts events, or a review of movies, music, or television shows. The advertisements do not have to be based on real products or events. Tell students that they will have the option to draw or paste pictures into the layout, using colored pencils and markers, computer clip art, or pictures scanned or downloaded from a digital camera. Help the groups choose names for their newspapers.

Part II: Writing the News

When groups are ready to begin working on their pages, assign each group to a computer. Encourage students to experiment with fonts and columns and to be creative. Provide assistance with formatting as needed. Remind students that they will each write one page of the newspaper, and have them follow these steps:

1. Open a new document in a word processing program. Enter the name of the newspaper at the top of Page 1 in a large font.
2. Insert the page number of your page in the top right corner.
3. Use the columns tool to set up columns. Write the articles, reviews, and advertisements in the columns. Articles should inform readers and be written in the third person, using formal language. Reviews should offer opinions and be written in the first person. Advertisements should persuade readers and can use informal language.
4. Add photographs or clip art, or leave space to include drawings after the page is printed.

Part III: Run the Presses!

Students should print their pages on 8½" x 11" sheets, which will be copied back to back on an 11" x 17" sheet and folded like a real newspaper. Have students follow these steps to publish the newspaper:

1. Print each page on an 8½" x 11" sheet. If students have not added clip art or digital photographs to their layouts, they may use colored pencils or markers to illustrate their pages.
2. With assistance from the teacher, photocopy the pages.
 - a. Place Page 1 and Page 4 facedown on the glass to copy the outside of the newspaper on an 11" x 17" sheet of paper.
 - b. Then, place Page 2 and Page 3 facedown on the glass to copy inside of the newspaper, using the other side of the 11" x 17" sheet of paper.
 - c. Make one 11" x 17" double-sided copy of the newspaper for each student in the group.
3. Fold each copy of the newspaper in half.

Accommodations and Extensions

Have students select four articles and advertisements from existing newspapers on topics similar to those listed in the activity, rather than writing their own. Have them paste the articles and advertisements onto the front and back of an 11" x 17" sheet of paper, following the page format outlined above. Encourage students to cut out words from existing newspapers and paste them at the top of the front page to create a newspaper title.

As an extension, have each student produce an additional page. The second page should include 1–2 additional articles or reviews on topics not already covered and 1–2 advertisements.

Closure

Distribute the newspapers to the class. Allow students time to trade newspapers and read the articles, reviews, and advertisements from other groups. Then, have students discuss the newspapers and ask each other what they found most challenging or interesting about writing and publishing them.

Assessment

Have students trade newspapers with a partner and use the *Printing the News* rubric to evaluate their partner's article and advertisement.

Radio Then and Now

A Lesson on the Role of Radio in Popular Culture

Content

Students will research and collect essential information about an assigned radio station.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

Science

Students should develop understanding of science and technology in society.

Social Studies

The learner can describe ways in which language, stories, folktales, music, and artistic creations serve as expressions of culture and influence behavior of people living in a particular culture.

The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Logical-Mathematical



Musical



Linguistic

Prerequisites

Students should read the book *Inventing the Radio* to familiarize themselves with the history of radio and its cultural impact. Also, students should practice their research and note-taking skills.

Materials

- *Inventing the Radio* books
- portable CD and cassette player
- classic radio programs on CD or cassette (available at many public libraries)
- student copies of the *Radio Then and Now* reproducible
- access to radios and the Internet

Instructional Procedure

Anticipatory Set

Before class begins, select AM and FM radio stations with appropriate programming and websites to assign to students for the activity.

To begin the lesson, review with students the timeline on the bottom of pages 14–15 of *Inventing the Radio*. Point out the rapid growth of commercial radio between 1920 and the 1930s. Ask: *From this timeline, what can you tell about the role of radio in popular culture?* Students may say that when commercial radio was introduced, it quickly entered its “golden age” as popular entertainment. Encourage students to compare radio’s role during this period to television’s role in the late twentieth century, or the Internet’s role today.

Class Discussion

Using the portable CD and cassette player, play selections from classic radio programs for the class. If possible, include selections of music, radio comedy, and radio drama from the Golden Age of Radio.

After playing the selections, ask students to share their thoughts. Some students might say that the classic radio programs are interesting, particularly because they use sound to suggest visual images. Some students may find the music and humor of the broadcasts dated and boring. Ask: *What do you like about these programs? What do you not like?* Then, ask students to compare and contrast the classic programs with radio programming of today. Students should note that there are few radio comedy and drama programs broadcast today. They should also mention different styles of music and subject matter.

Objectives

The student will be able to...

- understand the role of radio in popular culture
- recognize the unique qualities of classic radio broadcasts
- listen critically and compare and contrast different media
- conduct research and take notes

Activity

Tell students that they will examine radio broadcasting today. Divide students into small groups and distribute the *Radio Then and Now* reproducible. Assign one of the radio stations chosen beforehand to each group and have students write the call numbers of the stations at the top of the reproducible. Tell students to listen to their assigned stations and make notes about the programming that they hear. Explain that each station has a website, and that students should visit the website to further research the stations. Have students complete the reproducible with the information they gather.

Accommodations and Extensions

Assign commercial radio stations that broadcast music almost exclusively. Assist students with their Internet research on these stations.

As an extension, have students compare and contrast their assigned radio station with the newer media discussed on pages 30–31 of *Inventing the Radio*. Students should identify similarities and differences in programming, and explore how the new technologies are changing radio programming.

Closure

Have students report their findings. Then, ask students once again to compare and contrast classic radio programming with radio programming today. Ask: *After looking closely at radio today, what does it have in common with classic radio? How is it different?* Students should recognize that contemporary radio reflects the habits of its listeners. Programming is meant to entertain and inform when other media, such as television or the Internet, are not available.

Assessment

Evaluate student reproducible for thoroughness and accuracy.

No Phone Emergency!

A Lesson on Communication

Content

Students will recognize our reliance on telephones and other telecommunications devices by creating signal communication systems.

National Standards

The following standards will be addressed in the lesson:

Language Arts

Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

Math

Students should solve problems that arise in mathematics and in other contexts.

Science

Students should develop understanding of science and technology in society.

Social Studies

The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Bodily-Kinesthetic



Interpersonal



Logical-Mathematical



Musical



Visual-Spatial

Prerequisites

Students should read the book *Inventing the Telephone* to gain an understanding of communication before the invention of the telephone and the impact the telephone has had on society.

Materials

- *Inventing the Telephone* books
- student copies of the *No Phone Emergency!* reproducible
- flashlights
- flags in different colors
- drums or other simple percussion instruments
- bicycle horns or bells

Instructional Procedure

Anticipatory Set

Before class begins, write the following messages on separate sheets of paper: *Someone has been injured, My friend has a broken leg, We need medical help right away, Please send an ambulance, and Please help, this is an emergency.* You may want to write additional messages that are appropriate for the situation described in the activity.

To begin the lesson, review pages 4–7 of *Inventing the Telephone* with the class. Ask students to describe how people communicated over distances before the telephone was invented. Students should mention written messages, messengers traveling by foot, communication by signals and semaphores, and the telegraph. Ask: *How was communication before telephones different from communication now?* Students are likely to say that before the telephone, communication was much slower than it is today, and people did not feel as much need to communicate across distances.

Class Discussion

Ask: *What kinds of phones do you use? How often do you use a telephone?* (touchtone, cordless, or cellular phones; numerous times every day) Next, ask: *What do you use phones for?* (talk with family and friends, make plans, arrange transportation, send text messages) Write student responses on the board.

Tell students to imagine that there were no telephones. Ask: *Without phones, how would you communicate? What would you say?* If students respond that they would communicate through fax machines or over the Internet, tell them to imagine these options are not available either. (I would rely on means of communication that existed before the telephone was invented.)

Tell students that they will create ways to communicate without phones.

Objectives

The student will be able to...

- recognize the degree to which they rely on telephones
- create a system for nonverbal communication across distances
- work with a group to communicate nonverbally

Activity

Part I: Create Signals

Divide students into small groups and distribute the *No Phone Emergency!* reproducible. Tell the class to imagine that they live in a world with no telephones, radios, or other telecommunication devices. In emergencies, however, people need to communicate across distances. Therefore, each group must create a system for communicating.

Have each group create its own system of communication signals. Pass out the flashlights, flags, drums, and bicycle horns or bells. On the reproducibles, have groups write words or phrases they might use in an emergency. Then, have groups create a signal for each word or phrase. Tell groups that they can rely on gestures and movement to send their signals, or they can use flashlights, flags, drums, horns or bells. Make extra copies of the reproducible available.

Part II: Send a Message

When the groups have completed their signals, take the class outside. Tell each group to decide who will send and receive signals. Have the receivers walk away so that they cannot easily hear the senders. Then, give each group's senders one of the messages you wrote before class began. Give the senders ten minutes to communicate their messages to their receivers. Finally, bring the receivers back and have them report the message they received.

Accommodations and Extensions

Tell groups that they will use their signals to call for help in a medical emergency. If students have difficulty choosing words or phrases for their signals, suggest the following words: *help, emergency, ambulance, injury, and right away.*

As an extension, have students research forms of signal communications that are still used today, such as semaphore communication.

Closure

Compare the messages each group received with the actual messages sent. Encourage students to discuss the results. Then, ask: *What did this activity tell you about how much you rely on telephones?* Students should recognize that many people in modern society are very dependent on telephones for immediate and accurate communication.

Assessment

Evaluate signal communication systems for comprehensiveness and ease of use. Evaluate student performances for effort and accurate communication.

The Next Big Thing in Television

A Lesson on the Technological Developments and Uses of Television

Content

Students will demonstrate their understanding of how technology addresses social needs by proposing a television design for the future.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop abilities of technological design.

Students should develop understandings about science and technology.

Students should develop understanding of science and technology in society.

Social Studies

The learner can identify and describe examples in which science and technology have changed the lives of people, such as in homemaking, childcare, work, transportation, and communication.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:



Interpersonal



Linguistic



Visual-Spatial

Prerequisites

Students should read the book *Inventing the Television* to familiarize themselves with how modern televisions work, as well as current and prospective technological developments in television. Students should also practice drawing recognizable diagrams.

Materials

- *Inventing the Television* books
- student copies of the *The Next Big Thing in Television* reproducible
- library and Internet access

Instructional Procedure

Anticipatory Set

Before class begins, copy the timeline from pages 20–21 of *Inventing the Television* on the board. On the right end of the timeline, draw an arrow pointing ahead to a large question mark.

To begin the lesson, review with students the diagram of a cathode-ray tube television on pages 22–23. Ask students to explain how each component helps the television receive and produce moving images and sound. Students should point out that this television receives an electric signal through the cable and translates that signal into a cathode ray. The cathode ray then causes phosphors on the screen to glow, producing an image.

Point out that television technology has advanced beyond what is shown in the diagram. Then, ask: *How is the way television works changing?* Students might mention new developments such as satellite signals, plasma and liquid-crystal display (LCD) screens, and digital high-definition signals. Students may also mention television accessories such as video games, digital video recorders (DVRs), and surround-sound systems.

Class Discussion

Ask: *What is the most popular use of television?* (entertainment) Write the word *entertainment* on the board, and then ask: *What are some other ways people use television?* (news and educational programming, emergency broadcasting, videoconferencing and medical applications) Write student responses on the board.

Then, ask students to think about how existing and new technologies help television serve each of these purposes. Students may mention the use of cable and satellite technology to make more educational programming available, the use of high-definition technology in medical applications, and the use of video games, DVRs, and surround-sound to make television more entertaining.

Objectives

The student will be able to...

- demonstrate an understanding of how the modern television works
- recognize that television is used for a range of purposes
- apply understanding of how new technologies meet social needs

Activity

Briefly review with students the timeline on the board, emphasizing the question mark after the development of Internet broadcasting in 2000. Tell students that they will imagine and propose a new development for television. Divide students into small groups and distribute the *The Next Big Thing in Television* reproducible.

Tell students that they should start by thinking about the different purposes—such as entertainment, education, or information—of television. Then, students should think of ways in which a new television could better serve one or more of those purposes. Should the new television be smaller, more portable, or more interactive, for example? Encourage students to refer to the new technologies described on pages 24–25 and 28–31 of *Inventing the Television*. When students have decided what technologies their new television should use, have students complete the reproducible by drawing the new television, labeling its parts, and answering the questions.

Accommodations and Extensions

Have students complete the reproducible using a television that is available today. Students can use advertisements, technology reviews, or Internet resources to answer the questions.

As an extension, have students use library and Internet resources to research one or more of the new technologies described in *Inventing the Television*.

Closure

Have groups present their ideas to the class. Give students time to ask each group questions about their television. Conclude by discussing how students' presentations address the needs television viewers will have in the future.

Assessment

Evaluate student reproducibles and presentations for comprehensiveness. Student designs should be practical and address the concerns that viewers either have today or can be expected to have in the future.

Cars of the Future

Directions: Tell people about the car that you have designed and persuade them to buy it by completing the following advertisement.

The _____ is the car of the future!

The _____ has a _____ engine.

This is the engine of the future because

The _____ runs on _____ fuel.

This is the fuel of the future because

But that's not all! There's something else you should know about the _____!

Here are three reasons that you should drive the _____:

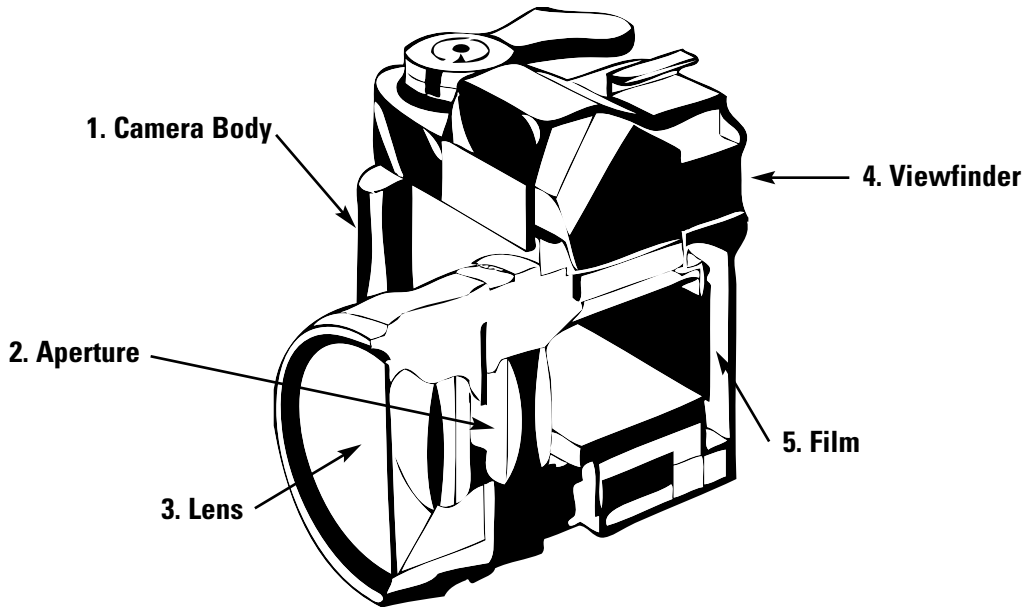
1. _____

2. _____

3. _____

Homemade Cameras

Directions: On the lines below the diagram, write what each part of a camera does. You may use your book to help you.



1. Camera Body

2. Aperture

3. Lens

4. Viewfinder

5. Film

Computers Hiding in Plain Sight

Directions: Find five items or devices you see or use every day that have microprocessors inside of them. On the chart, write the name of each item, where you found it, how you use it, and what the microprocessor does.

What It Is	Where You Found It	How You Use It	What the Microprocessor Does

Lighting Smart

Directions: In the chart, record information about the electric lights in one room in your school or home. Then, write which lights you would remove or replace. Use the chart to calculate how much energy you would save. Finally, write a description of your plan.

Location and Room: _____

Type of Light	Number and Type of Bulbs	Watts per Bulb	Total Watts
Total Watts Used Now:			

Incandescent Bulb	Equivalent Compact Fluorescent Bulb (Average)
40 Watts	11 Watts
60 Watts	14 Watts
75 Watts	21 Watts
100 Watts	27 Watts

1. I plan to remove the following lights, _____, _____. This will save _____ watts.

2. I plan to replace the following incandescent bulbs, _____, _____, with the following compact fluorescent bulbs, _____, _____. This will save _____ watts.

3. Describe your energy-efficient lighting plan below, including total watts saved.

Printing the News

Directions: Read your classmate’s newspaper article and advertisement. Then read each question below. Write an X in the box for your answer.

Classmate’s name: _____

	Yes	No
Does the page include an article and an advertisement?		
Does the page have the correct page number in the top right corner? (Page 1: School news and events; Page 2: Community news; Page 3: Sports; Page 4: Arts)		
Does the page appear in the correct order? (Pages 1 and 4 should be on the outside of the newspaper; Pages 2 and 3 should be on the inside of the newspaper.)		
Does the article or review use appropriate language and the correct point of view to tell you about the topic?		
Does the advertisement use appropriate language to persuade readers to buy the product advertised?		
Do the illustrations, photographs, or graphics help to communicate the content of the article and advertisement?		

Radios Then and Now

Directions: Answer the following questions about your assigned radio station.

Station Call Letters: _____ AM or FM? _____

Frequency: _____ Website URL: _____

1. From what town or city does this station broadcast?

2. Does this station broadcast music? If so, what kinds of music does it broadcast?

3. Does this station broadcast news and information? If so, describe its news and information programming.

4. What other kinds of programming, if any, does this station broadcast?

5. Is this a commercial station or a publicly funded station? Explain.

6. Would you recommend listening to this station? Why or why not?

No Phone Emergency!

Directions: Write words and phrases you want to communicate in the left column. Write symbols or choose sounds for the words in the right column.

Word or Phrase	Signal

The Next Big Thing in Television

Directions: Draw your television of tomorrow and label its parts. Then answer the questions below.

1. What features does your television have?

2. Does your television require special tools or services? If so, what are they?

3. How will your television benefit viewers?
