History of Communications

How We Use the Telephone

Using the Telephone in an Emergency

Alphabetizing

Communications and the Community

How the Telephone Works

A COMMUNICATIONS AND TELEPHONE PROGRAM

FOR LOWER ELEMENTARY GRADES

TELEZONIA

TEACHER'S GUIDE

"No force helping the individual or the nation to grow is stronger than education . . . As a basic force for progress, the American educational system deserves to be continually assisted by the intelligent effort of all citizens, private and corporate."

— FROM THE BELL SYSTEM'S "STATEMENT OF OBJECTIVE — SCHOOL AND COLLEGE RELATIONS"

TO THE TEACHER

The Telezonia program has been developed for the lower elementary grades on the advice of educators and through their cooperation.

The program provides teaching aids related to communications; aids not otherwise available, based on sound educational theory, and designed to be of practical value to you in your own classroom.

This guide describes the teaching aids and offers a number of classroom activities.

Each of the aids is designed so it can be used alone or to supplement other materials in the program.

Many of the classroom activities were suggested by teachers who assisted in the program's development; those on science were developed with the help of Bell Telephone Laboratories.

The information and materials are organized so that you can adapt them to your own situation. You will decide the way in which they are to be used in your classroom. They are yours to promote your own objectives as a teacher.

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TELEZONIA

SCOPE OF THE PROGRAM

A COMMUNICATIONS AND TELEPHONE PROGRAM FOR LOWER ELEMENTARY GRADES

Telezonia teaching aids and activities emphasize:

- Language arts
- Social Studies
- Science

These are the general concepts developed:

- Communication is important in family and community living
- Good speaking and listening habits improve communication
- The telephone is an important means of communication
- There are correct ways to use a telephone
- The telephone directory helps us to use the telephone more efficiently
- Sound and electricity help make the telephone work

These are the teaching tools:

PRACTICE TELEPHONES:

In addition to practice telephones, a special activating unit, the Teletrainer, is available in most areas. It is an amplifier and control unit which produces dial tone, ringing and busy signals, and makes connections between two telephones which accompany the unit. Role-playing with the Teletrainer stimulates interest in the communications unit, develops listening and speaking skills, and provides opportunities for teaching social studies and science.

FILM:

25-minute, 16mm., color; "We Learn About The Telephone."

The film is an introduction to a classroom unit on communications. It can also be used as a review at the end of the unit. It covers several aspects of communications, some of which are developed further in the other Telezonia materials.

FOUR FILMSTRIPS:

- "How We Use The Telephone" – proper use of the telephone, and courtesy.
- "The Alphabet Works For Us" – alphabetizing, looking up names, telephone numbers, and facts in reference books.
- "Communications And The Community" – community communications related to social studies.
- "How The Telephone Works" – sound waves; and how electricity, magnetism and carbon help make the telephone work.

Each filmstrip is closely related to an important segment of the film. It reinforces and expands on the subject, and permits class participation. Each can also be used without the film, since all have been designed so they can stand alone.

Suggested commentary for each filmstrip is in the last section of this guide.

THREE WALL CHARTS:

- "Telephone Courtesy" – animals dramatize some undesirable telephone habits.
- "How We Get Help In An Emergency" – simple, specific instructions on emergency use of the telephone.
- "How The Telephone Works" – sound and electricity work together to carry voices over wire.

These can be used as supplementary material to the film and the filmstrips or they can be used alone. They are available from your telephone company.

PUPIL'S BOOKLET:

"We Learn About The Telephone" is a 24-page booklet written for lower elementary pupils. It reviews most of the principal subjects contained in the Telezonia program and is a reminder of what the child has learned.

CLASSROOM ACTIVITIES:

Many of the classroom activities in this guide have been developed by teachers while others, on science, have been designed and tested specifically for the Telezonia program.

Because communications is frequently taught in two or more grades at the lower elementary level, the Telezonia program has been made flexible so that it can be used at different grade levels, depending on school practice.

Practice Telephones

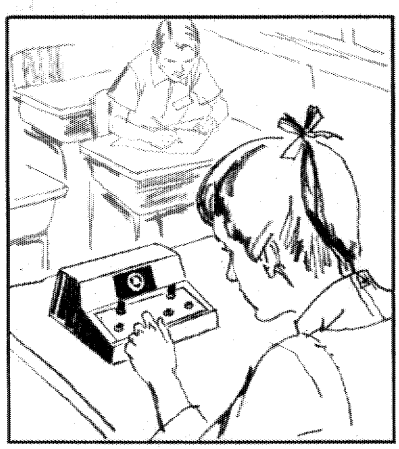
Practice telephones are available from telephone company representatives or local Bell Telephone offices.

THE TELETRAINER

The Teletrainer consists of two activated telephones and a loudspeaker-control unit. It provides dial tone, ringing and busy signals. This "live" telephone equipment is an aid in creating realistic classroom situations for practice in developing conversational skills.

Each telephone is especially equipped with a 25-foot cord so that the instruments can be placed well apart in the classroom, or in two separate rooms.

This equipment is available in most communities.



VALUE OF TELEPHONE PRACTICE

Use of the Teletrainer stimulates interest in the communications unit and helps teach language arts, social studies and science. Specifically, its use –

- Advances pupils' imagination and learning through realistic role playing
- Develops listening and speaking skills
- Demonstrates need for courtesy and good manners
- Increases confidence in telephone situations
- Encourages shy pupils to participate
- Demonstrates the science of the telephone

SETTING UP THE TELETRAINER

- Place control unit on table with speaker (side opposite controls) facing the class.
- Attach telephones to control unit. Plugs fit only one way.
- Plug power cord into AC outlet only.
- Turn switch to "On."
- Allow a moment for the unit to warm up.
- Adjust volume control to suit size of room.
- Move telephones further from control unit if a feedback "howl" develops.

TELETRAINER OPERATOR

Select a student as the Teletrainer operator. The operation is as simple as tuning a TV channel. This is the procedure:

1. When the "caller" lifts the telephone receiver, depress the dial tone control. This gives the calling student a dial tone.
2. When "caller" begins to dial, release dial tone control.
3. Depress "ring left" or "ring right" control to ring the other telephone when "caller" completes dialing.
4. Release this control when telephone has been answered.

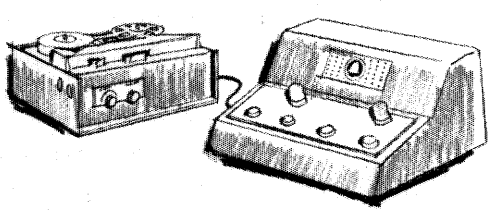
For additional realistic practice, the operator may:

- Depress "busy signal" control after caller completes dialing. The caller, recognizing the signal, should hang up the receiver, wait a short while and redial the number.
- Wait a short while before depressing dial tone control. This will teach the caller the necessity for waiting for the dial tone before dialing.

RECORDING WITH THE TELETRAINER

The "output" outlet on the Teletrainer control unit permits connection of a tape recorder. Here are some advantages in playing back recorded conversations:

- Pupils can hear themselves and recognize need for speech improvement.
- Playback aids class discussion of correct and incorrect features of the conversation, and enables the class to suggest better ways.
- Improvement can be determined by comparing early and later recordings.



ROLE-PLAYING WITH TELEPHONES

Students using the telephones should face away from each other and the class. This makes it possible to rely on voice-to-voice communications as a means of conveying ideas and creating impressions. In this manner, the callers are not distracted by others in the classroom.

By taking turns on the telephones in role-playing situations, all members of the class have an opportunity to use the telephone properly under teacher supervision. Children can, by making various types of calls, gain additional knowledge of the role of communications in the community.

You may wish to have the children think up role-playing situations, including several which involve taking simple messages. Some suggestions:

- A telephone call to mother to ask if the child may remain at a friend's house for supper. If mother permits the child to remain, she might tell him what time to be home.
- A telephone call to a storekeeper to order butter, eggs and milk (a list should be made by the student first). The storekeeper should repeat the order, write it down and tell when it will be delivered. The caller should give his name and address, and might suggest time of delivery.
- A call to the Fire Department to report a fire. (If the operator is called, she should find out the address where the fire is and the name of the person calling. She would then normally connect the caller to the Fire Department and stay on the line until the conversation is underway. Since the Teletrainer accommodates only two telephones, she will have to simulate staying on the line.)
- A call to the Police Department to report a serious auto crash.
- Receiving a call to a member of the family who is not at home. (Person receiving the call should take down important information such as the name of the caller, convenient time to be called back, telephone number where caller can be reached, any message.)
- A wrong number call, demonstrating courtesy by apologizing for the mistake.
- A call to a friend's house to invite them to a party.
- A call to the neighborhood theater to see what time the feature starts at the Saturday afternoon matinee. (In some locations this is a recorded message, which can be a subject for class discussion.)
- A call to a classmate who is home ill, to inquire how he is feeling and to tell about happenings at school, a recent class field trip, or some coming event.
- A call to the dentist – at mother's request – to change child's dental appointment to another time and date.
- Receiving a call from president of mother's PTA group or club, in which the date of an event is changed to another date.

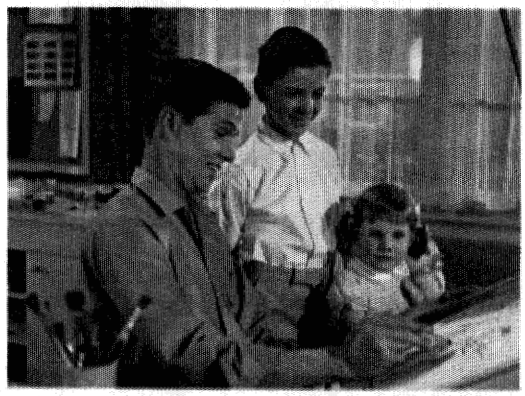
A Motion Picture On Communications

"WE LEARN ABOUT THE TELEPHONE"

This 25-minute, 16mm., color film deals with several aspects of communications and the telephone. It combines live and animated sequences, and covers a number of subjects which receive expanded treatment in other Telezonia materials.

SCOPE OF THE FILM:

It is the story of Jimmy, a 9-year old boy, and his 4-year old sister, Susie, who visit their Uncle Bill on a rainy day. While they wait for the rain to stop so they can go on a picnic, they become interested in the telephone. Their uncle, who is an artist, tells them a number of things about the telephone with the help of an animated character he draws, called Mr. Man.



In their discussions and experiences the children learn:

- The proper way to use the telephone.
- The importance of telephone courtesy.
- How to find a number in the telephone book.
- How the telephone works.
- The history of communications.
- Importance of the telephone in the community.
- How to get help in an emergency.

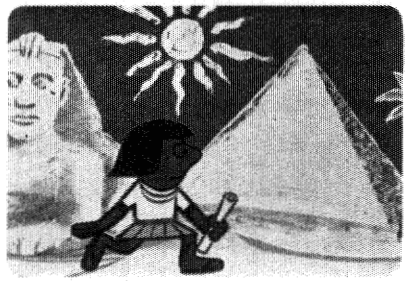
The story is told in a simple, dramatic way which holds the children's attention, but does not distract from the teaching points in the film.

Some representative scenes from the film are on the following pages.

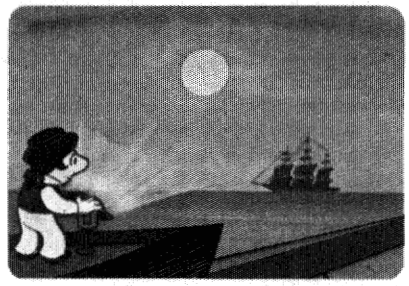
PRE-SHOWING ACTIVITIES AND INTRODUCING THE FILM

1. Discuss some of the following topics, telling the children that they will be covered by the film.
   - Communications; how we get messages to each other
   - How men communicated before the telephone was invented
   - How we look up telephone numbers, facts in the dictionary or in the encyclopedia
   - How to place a call
   - The importance of the telephone in the community
   - How the telephone works
   - Words which will be used in the film, such as transmitter, sound waves, code messages, electricity, eardrum, vocal cords, vibration
   - What each child should do in an emergency
2. Have the class volunteer rules for using the telephone properly and courteously. List the rules on the chalkboard before the showing, then after the film have the children add new rules they have learned.
3. Ask what new communication inventions and developments we have today. The children may be interested in communications satellites, communication with astronauts, the Picturephone. They may also mention communications of the future, to other planets.

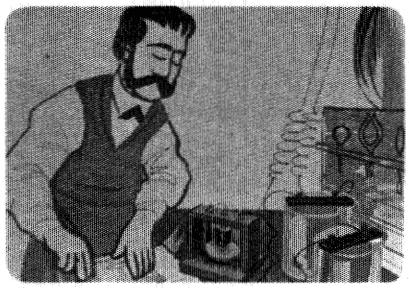
"WE LEARN ABOUT THE TELEPHONE"



"He used to have to run to deliver messages."

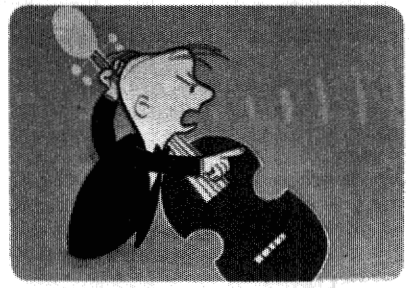


"Later he learned to use flashing lights."

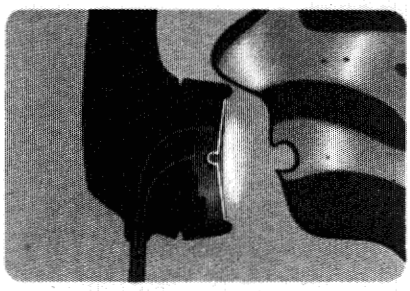


"Alexander Graham Bell invented the telephone."

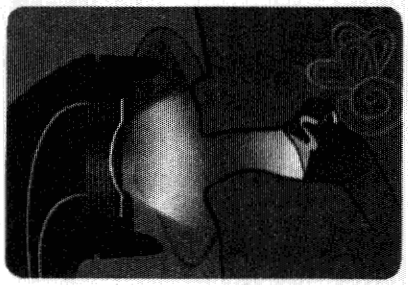
"But, how does the telephone work?"



"First, we learn about sound waves."

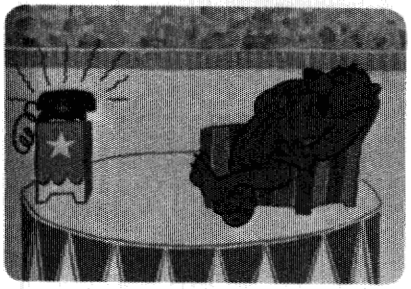


"The transmitter changes sound waves to electrical waves."



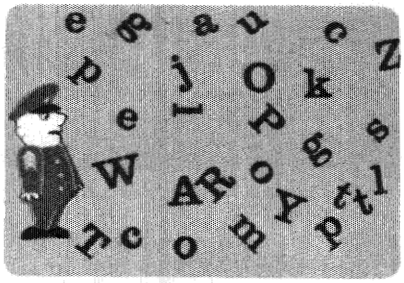
"Then the receiver changes the electrical waves back to sound waves."

"We must not play with the telephone."

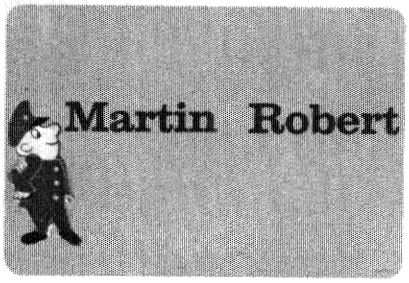


"Answer the telephone promptly."

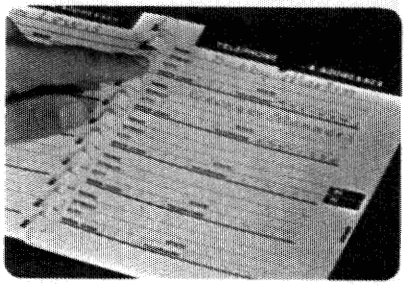
"How do I look up Bobby's number?"



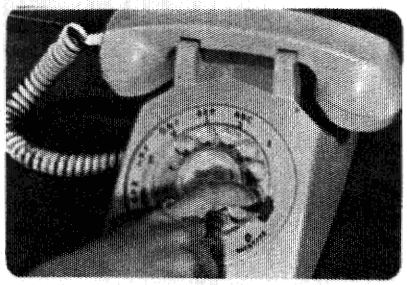
"First you must know the alphabet."



"Remember that the last name comes first."



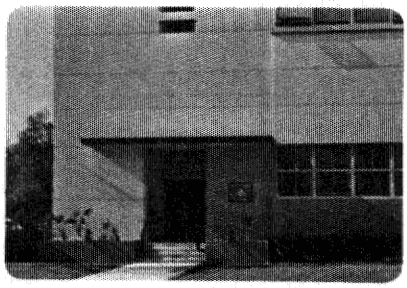
"Write telephone numbers down."



"Bring your finger all the way to the finger stop."

"In an emergency, dial '0' (Operator)."

"Be sure to listen for the dial tone first."



"All our calls go through the telephone building."

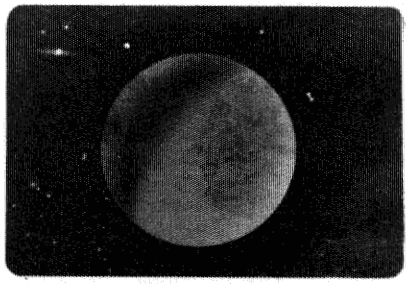
"We call mother to say when we'll be home."

"Mother makes an appointment with the doctor."

"Storekeepers order things to sell."

"The telephone operator helps us when we need assistance."

"The telephone can even reach up into the sky."



"Communications satellites can carry telephone messages and TV pictures."

Language Arts

TEACHING POINTS

for lesson planning, class discussion, quizzes and review

	SOURCES				
USING THE TELEPHONE	Film	Film Strips	Wall Charts	Pupil's Book	Practice Telephones
Know own number	●	1		●	
Placing a call	●	1	B	●	●
Know correct number	●	1, 2		●	
Directory, use of	●	2		●	
Write number down	●	1, 2		●	
Personal Number List	●	1, 2		●	
Listen for dial tone	●	1	B	●	●
Dialing properly	●	1	B	●	●
"I" and "1" on dial	●	1	B	●	●
"O" and "zero" on dial	●	1, 2	B	●	●
Finger to finger stop	●	1	B	●	●
Let dial return	●	1	B	●	●
Busy signal procedure	●	1		●	●
Wrong number procedure	●	1		●	●
Wait ten rings when calling	●	1			●
Handset position	●	1	B	●	●
Identify yourself	●	1	B	●	●
Use normal voice	●	1	A	●	●
Receiving a call	●	1	A	●	●
Answer promptly	●	1	A	●	●
Identify yourself	●	1			●
Summoning others	●	1			●
Message taking	●	1		●	●
COURTESY			A		
Answer promptly	●	1	A	●	●
Apologize for wrong number	●	1		●	●
Identify yourself	●	1		●	●
Speak clearly, distinctly	●	1	A	●	●
Summon person telephoned	●	1			●
Take a message	●	1		●	●
Use normal voice	●	1	A	●	●
Wait ten rings when calling	●	1			●
Replace telephone carefully	●	1		●	●
Share the telephone	●	1	A	●	
ALPHABETIZING					
Fundamentals	●	2		●	
Dictionary, use of	●	2			
Encyclopedia, use of	●	2			
Telephone Directory, use of	●	2		●	

CODE

1. "How We Use The Telephone"
2. "The Alphabet Works For Us"

A. "Telephone Courtesy"
B. "How To Get Help In An Emergency"

The following five pages describe two Language Arts filmstrips, "How We Use The Telephone" and "The Alphabet Works For Us" and a wall chart on "Telephone Courtesy."

"HOW WE USE THE TELEPHONE"

This 40-frame, color filmstrip teaches proper use of the telephone, courtesy and consideration for others.

Representative scenes for the filmstrip appear on the next page. Suggested narration begins on page 42.

Major teaching points covered in the filmstrip are:

- Equipment and machines will work better when used correctly.
- Proper use of the telephone.
- Getting the right telephone number and writing it down.
- Knowing the telephone dial, and how to use it.
- Identifying oneself when making or answering a call.
- Speaking clearly and distinctly.
- Having consideration for others.
- Taking a message.
- Using the telephone in an emergency.

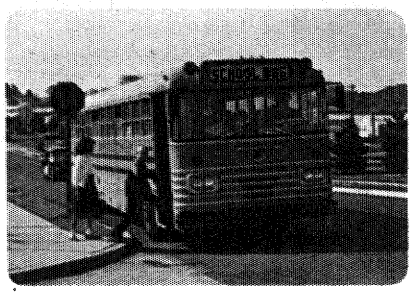
PRE-SHOWING ACTIVITIES

The children's interest in the presentation will be increased by discussing information in the filmstrip before it is shown. Questions relating to the listed teaching points will indicate the level of the pupil's knowledge and suggest which points should be emphasized during the presentation of the filmstrip.

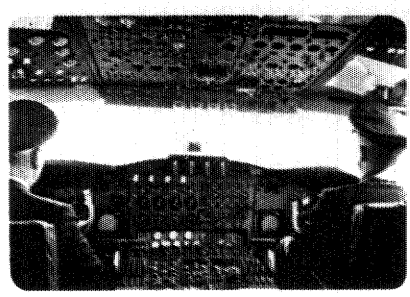
POST-SHOWING ACTIVITIES

Suggestions for post-showing activities and projects begin on page 26.

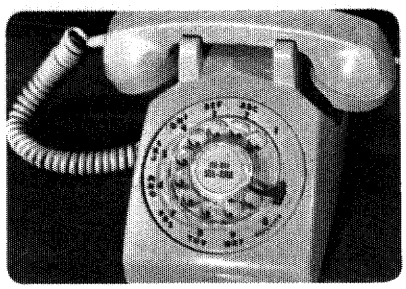
Scenes from "How We Use the Telephone"



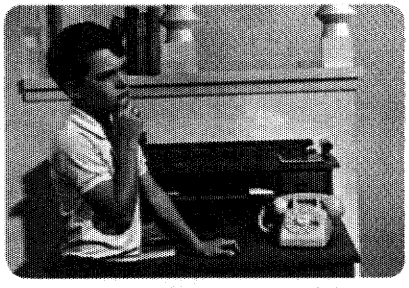
"The driver has to know how to operate the bus."



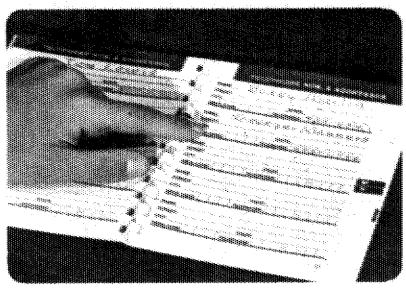
"The pilot has to know how to operate his airplane."



"We have to make sure we use the telephone correctly—or it won't perform properly."

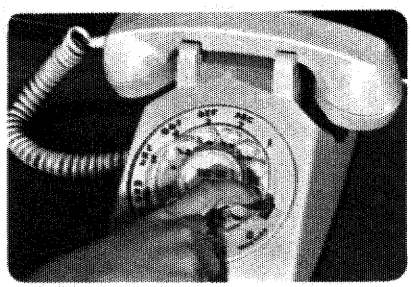


"Not sure what the number is? He should look it up."

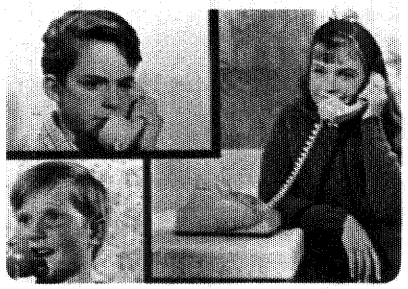


"Keep your own number list. It is quicker than using the big directory."

"Listen for the dial tone before dialing."



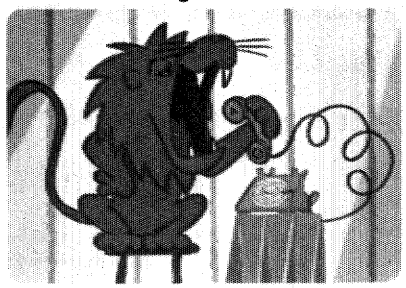
"We dial each numeral all the way around to the finger stop."



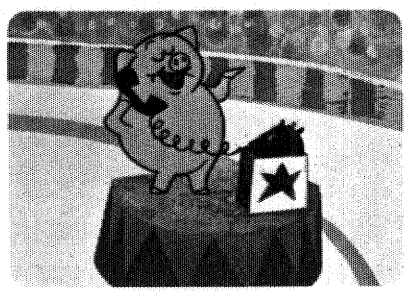
"When you hear the busy signal, hang up, wait a while and try again."

"If you call the wrong number, apologize before hanging up."

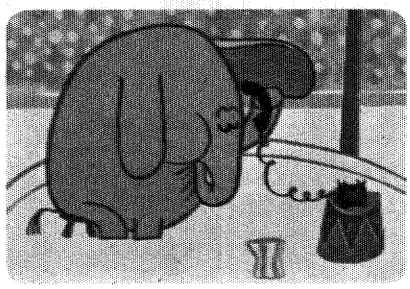
"Hold the telephone like this: against your ear; close to your mouth."



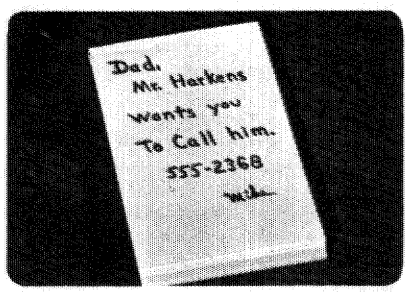
"Speak clearly and directly into the transmitter. Don't roar."



"It's selfish and impolite to 'hog' the telephone."



"And people can't understand you if you talk with your mouth full."



"If you take a message, remember to deliver it."

"If you know how to use it, the telephone will serve you well."

Language Arts Wall Chart

TELEPHONE COURTESY

This wall chart will help you emphasize the importance of courtesy in using the telephone. Several of the animal characters used appear in the motion picture and in the filmstrip, "How We Use The Telephone."

The chart is in color and measures 24 x 36 inches.

Language Arts Filmstrip

"THE ALPHABET WORKS FOR US" (Alphabetizing)

This 45-frame filmstrip will help you teach alphabetizing and the use of the telephone directory and other reference books. Suggested commentary for this filmstrip begins on page 46.

The filmstrip covers the following areas:

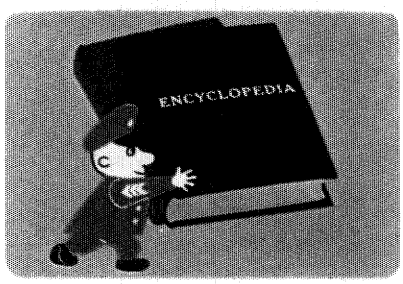
- Fundamentals of alphabetizing
- How to look up telephone numbers
- Writing down names and numbers for easy and accurate reference
- How to use the telephone in an emergency
- How to look up words in the dictionary
- How to look up facts in an encyclopedia

PRE-SHOWING ACTIVITIES

Ask the children questions about the above topics to determine their level of knowledge and help you decide which points will require special emphasis during the filmstrip presentation. Such discussion will also produce higher interest in the filmstrip and better retention.

POST-SHOWING ACTIVITIES

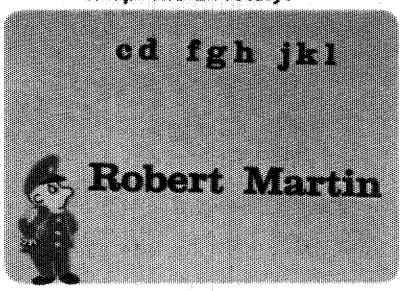
Suggested post-showing activities begin on page 26.



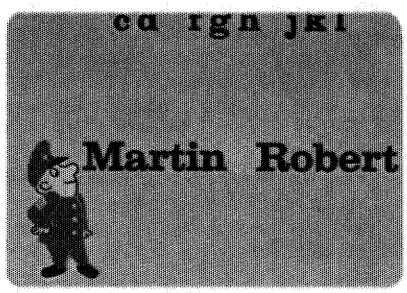
"How do we find things in the encyclopedia, dictionary, and the telephone directory?"

"The sergeant will show us how."

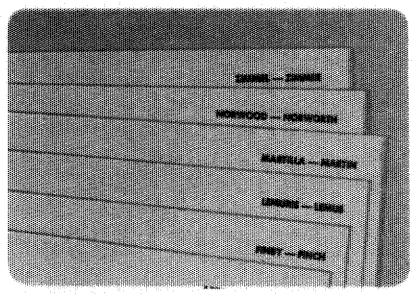
"We'll start with an alphabet drill."



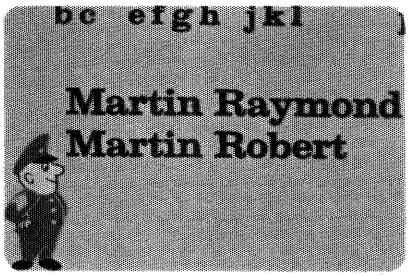
"Now the letters form the name Robert Martin."



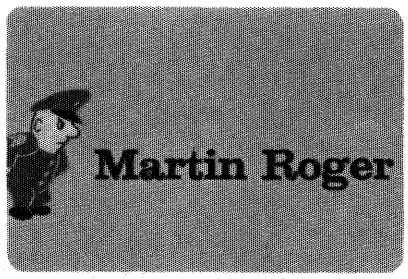
"In the telephone book, last names come first."



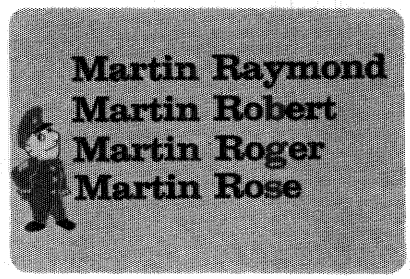
"Martin will be under the 'M's in the telephone directory."



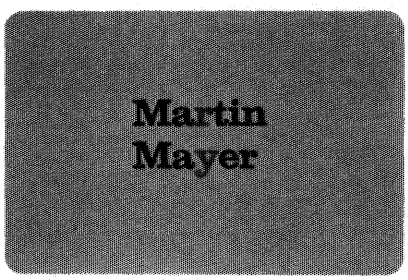
"Suppose we were looking for Raymond Martin. 'RA' comes before 'RO'."



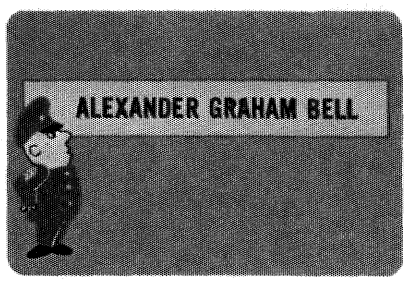
"Would Roger come before or after Robert?"



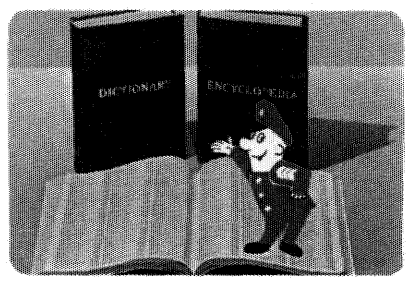
"Here are the names together."



"The last name, Martin, comes before Mayer because 'R' comes before 'Y'."



"The encyclopedia and the dictionary work the same way. Let's look up Mr. Bell."



"The alphabet helps you unlock all the secrets in these three books."

THE TELEPHONE DIRECTORY

Your local telephone directory can be a useful aid in teaching alphabetizing and as a source of information about the community and the telephone. Directories may be obtained from your telephone business office or from Company representatives.

The directory is divided into the following three sections:

INTRODUCTORY PAGES

Most telephone directories show:

- a place to write emergency numbers
- special numbers, such as Weather and Time of Day service
- how to get information and assistance in placing a call
- how to place long distance and other types of calls
- local calling areas
- area code map
- telephone office address

ALPHABETICAL LISTING

This portion of the directory will be of most use to the class. Here they will find the names, addresses and telephone numbers of people in the community.

THE YELLOW PAGES

This section can be an aid in teaching about community helpers and businesses, as well as in teaching alphabetizing. Organizations and individuals are listed alphabetically under the services they perform or the goods they sell.

The teacher who wishes to use the Yellow Pages might find the following classroom activity helpful.

(1) Have the class suggest community helpers and determine the heading under which they would appear.

(2) The children can then find the telephone numbers of these stores and services.

In some communities, the Yellow Pages are bound in a volume with the other sections. In others, they are in a separate directory.

Social Studies

TEACHING POINTS

for lesson planning, class discussion, quizzes and review

	SOURCES				
	Film	Film Strips	Wall Charts	Pupil's Book	Practice Telephones
SOCIAL SIGNIFICANCE OF COMMUNICATIONS	●	3		●	
Businesses	●	2, 3		●	●
Community helpers	●	2, 3	B	●	●
Telephone installers		3			
Operators	●	1, 3	BC	●	●
Parents	●	3			●
Social uses	●	3		●	●
HISTORICAL COMMUNICATIONS	●	3		●	
Early man	●	3			
Runners	●	3		●	
Drums				●	
Smoke signals	●	3		●	
Pony express	●	3		●	
Pigeons				●	
Flashing lights	●	3		●	
MODERN COMMUNICATIONS					
Mail		3		●	
Newspapers and books		3		●	
Radio and television		3		●	
Roads		3			
Satellites	●	3			
Space	●	3			
Telegraph, Samuel Morse	●	3			
Telephone, A. G. Bell	●	3		●	
Tomorrow's communications	●	3			
World-wide communications	●	3			
EMERGENCY USE OF TELEPHONE					
Dial "zero" for Operator	●	1, 2, 3	B	●	●
Confusion of "O" and "zero"	●	1, 2	B	●	●
Wait for dial tone	●	1	B	●	●
Tell who you are	●	1, 2	B	●	●
Tell where help is needed	●	1, 2	B	●	●
Tell why help is needed	●	1, 2	B	●	●

CODE

1. "How We Use The Telephone"
2. "The Alphabet Works For Us"
3. "Communications And The Community"

A. "Telephone Courtesy"
B. "How To Get Help In An Emergency"
C. "How The Telephone Works" wall chart

The following three pages describe a Social Studies filmstrip, "Communications And The Community," and a wall chart, "How To Get Help In An Emergency."

"COMMUNICATIONS AND THE COMMUNITY"

This 46-frame filmstrip expands on the social significance of communications which is covered only briefly in the motion picture.

Some of the scenes from the filmstrip appear on the next page. Suggested narration begins on page 50.

The following topics are covered:

- A brief history of communications from the caveman to the invention of the telegraph and telephone.
- The ways communications join the community, the nation and the world together.
- How we use communications in the home and in business; how community helpers use communications.
- Emergency use of the telephone; how to get help.
- A glimpse of communications by satellites – the kind of continuing development needed to meet today's and tomorrow's requirements for worldwide communications.

PRE-SHOWING ACTIVITIES

Some pre-showing discussion topics which will increase the pupils' interest in the filmstrip, and point out areas for emphasis:

- How man communicated before today's methods were available to him.
- The types of communications we use today.
- Ways we, our parents, and community helpers use communications in everyday life.

Facts from these discussions may be listed on the chalkboard. Right after the showing, add additional facts learned from the film. Groups may also be assigned to further research on the topics, using school library resources.

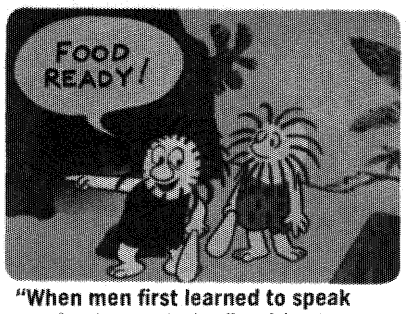
POST-SHOWING ACTIVITIES

Suggested classroom activities and projects begin on page 26.

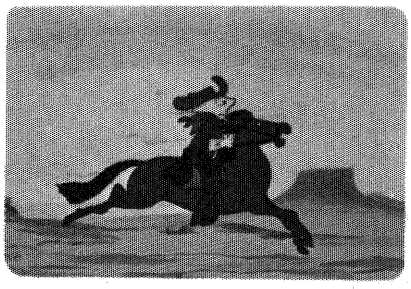
Scenes from "Communications and the Community"

"These streets are pathways that help bring people together in a town or city."

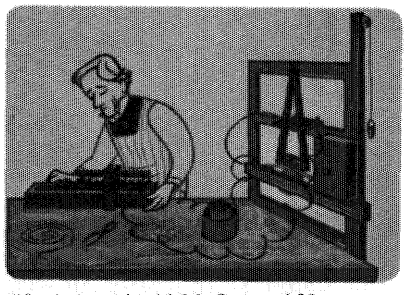
"Some wires are pathways, too, as we'll learn."



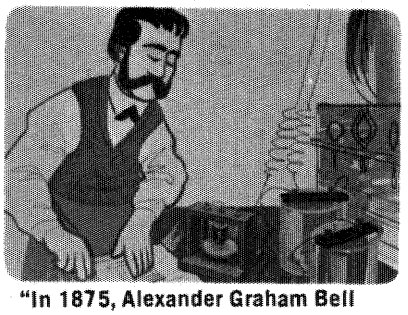
"When men first learned to speak words, they took the first big step in communication."



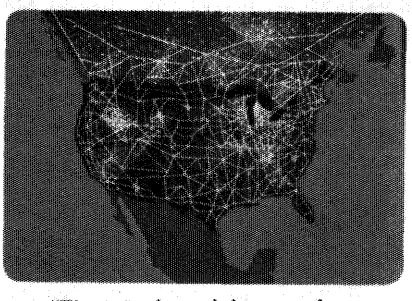
"On horseback, he could communicate farther and faster."



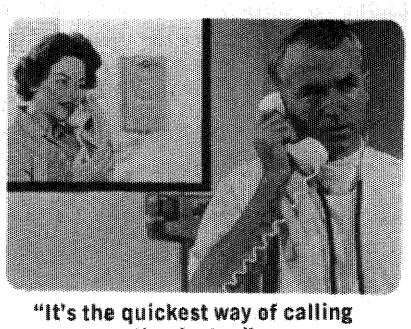
"And then, in 1844, Samuel Morse invented the telegraph."



"In 1875, Alexander Graham Bell invented the telephone."



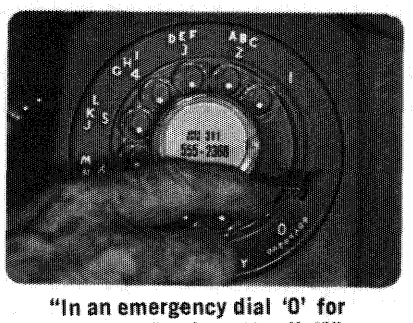
"The telephone joins people together over communications pathways."



"It's the quickest way of calling the doctor."

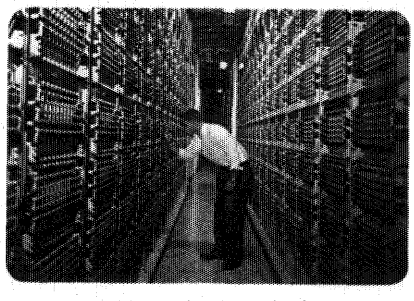
"Or telling your mother where you are."

"A storekeeper orders the goods he sells to your family."



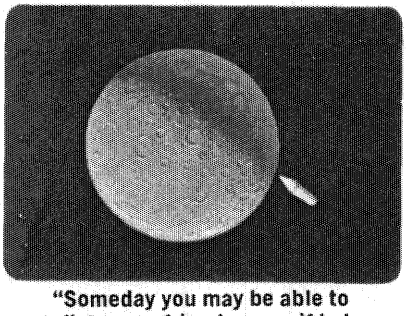
"In an emergency dial '0' for operator. See it on the dial?"

"She will connect you with the police or others who will help you."

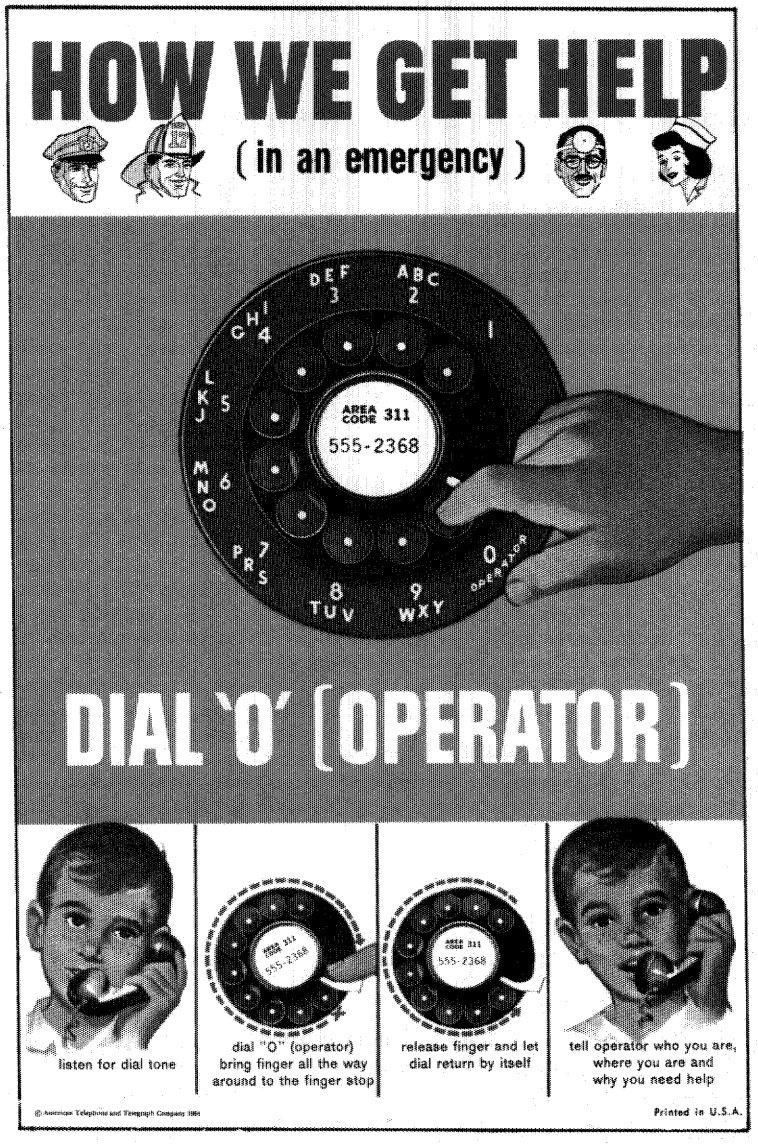


"Machinery in the telephone building also can connect you to other people."

"The telephone connects us to different countries, and even around the world."



"Someday you may be able to talk to your friend—even if he's on the moon!"



USING THE TELEPHONE IN AN EMERGENCY

One of the most important elements of the communications program concerns emergency use of the telephone. Its purpose is to give the child the skill and ability to get emergency help when needed. Fire Departments, Police and other emergency service organizations also place great emphasis on this subject.

Young children tend to panic when using the telephone in an emergency. The more familiar the child is with the correct procedure, the more effective he will be in an emergency.

The wall chart is the same one shown in the motion picture. It measures 24 x 36 inches and presents, step by step, the proper method of getting emergency help when the correct telephone number is not known.

The large dial can also be useful in discussing the telephone dial and proper dialing procedures for normal telephone calls. It is a useful aid in helping children avoid confusion between the numeral "0" and the letter "O", and between the numeral "1" and the letter "I".

Coin Telephones

The coin telephone is an important means of getting emergency help. In the event of a fire, for example, the child is instructed to leave the burning building, go to the nearest telephone, and call for help. The closest telephone may be a coin telephone, and the child should know how to use it.

Coin telephones are much the same throughout the country, but there are some differences in their operation. Instructions are found on the front of the telephones.

Instructions for most coin telephones are as follows:

1. Lift receiver
2. Insert coin
3. Listen for the dial tone
4. Dial

TEACHING POINTS

for lesson planning, class discussion, quizzes and review

	SOURCES				
	Film	Film Strips	Wall Charts	Pupil's Book	Practice Telephones
ELECTRICITY					
Electromagnet		4	C	●	●
Flow of electricity	●	4	C	●	●
Telephone converts sound into electricity, and back to sound	●	4	C	●	●
Wires	●	4	C	●	●
SOUND					
Generating sound	●	4	C	●	●
Vibrations	●	4	C	●	●
Lungs	●	4	C	●	●
Vocal cords	●	4	C	●	●
Types of sound	●	4	C	●	
Transmitting sound	●	4	C	●	●
Sound waves	●	4	C	●	●
Air transmission	●	4	C	●	●
Hearing sound	●	4	C	●	●
Eardrum	●	4			
Nerves		4			
Brain		4			
TELEPHONE					
Transmitter	●	4	C	●	●
Diaphragm	●	4	C	●	
Carbon granules		4	C	●	
Changing sound waves into electrical waves	●	4	C	●	●
Receiver	●	4	C	●	●
Diaphragm	●	4	C	●	
Electromagnet		4	C	●	●
Changing electrical waves back to sound waves	●	4	C	●	●
Telephone building function	●	3, 4	C	●	
Invention and development	●	3, 4		●	

CODE

3. "Communications And The Community"
4. "How The Telephone Works" filmstrip
C. "How The Telephone Works" wall chart

The following three pages describe a Science filmstrip and a wall chart, both entitled "How The Telephone Works."

"HOW THE TELEPHONE WORKS"

In explaining how the telephone works, this 54-frame filmstrip deals with sound, electricity and magnetism.

- The nature of sound
  - how sound is made
  - how we create voice sounds
  - what sound waves are; how they differ
  - how sound is transmitted
  - how we hear sound
- Electricity
  - how the telephone transmitter works
  - how the telephone converts sound into electrical energy and back again
  - how the electrical impulse carries voice patterns
- Magnetism, including the electromagnet
  - how the telephone receiver works

The filmstrip also tells about Alexander Graham Bell's work with sound and the invention of the telephone.

Scenes from the filmstrip appear on the next page. Suggested narration begins on page 54.

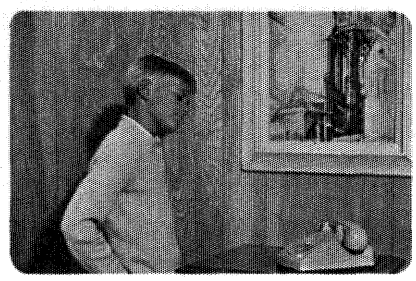
PRE-SHOWING ACTIVITIES

Discuss sound and how the telephone works to increase the children's interest in the filmstrip and make them more familiar with the subject. Ask questions relating to the topics listed above and determine the children's familiarity with words such as transmitter, energy, sound waves, diaphragm, vibrations. From these discussions you can determine what parts of the filmstrip will require special emphasis.

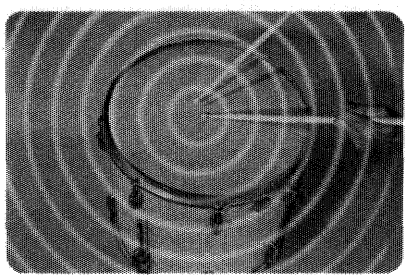
POST-SHOWING ACTIVITIES

Suggested classroom activities and projects on science begin on page 30. They include simple experiments which will help children understand the nature of sound and how the telephone works. You may want to assign children to obtain material for these experiments early in the program so they will be ready for use when needed. You may also want to try the experiments yourself first to assure their success.

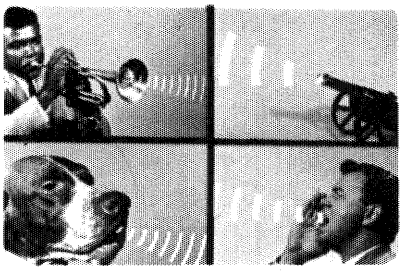
Scenes from "How the Telephone Works"



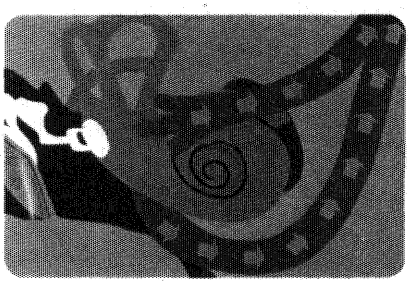
"But how does the telephone work?"



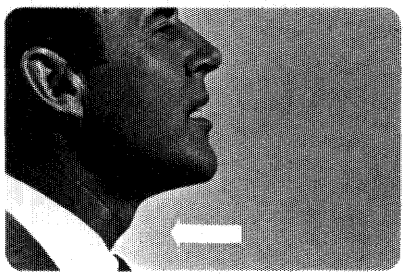
"First we have to learn about sound."



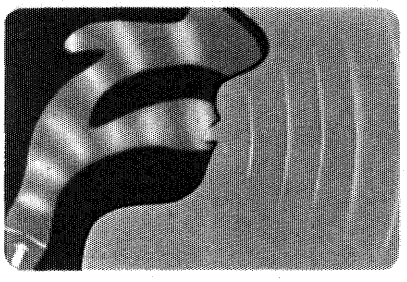
"Different things produce different sound waves. How do we hear them?"



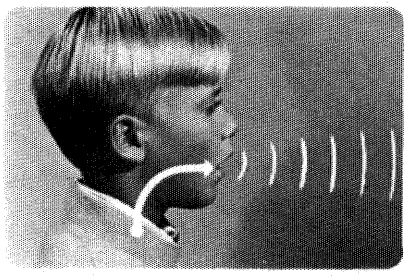
"When sound makes the eardrum vibrate, it passes the pattern of sound to your brain."



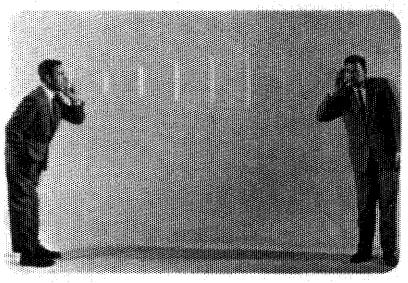
"To speak, we each have two vocal cords in our throats."



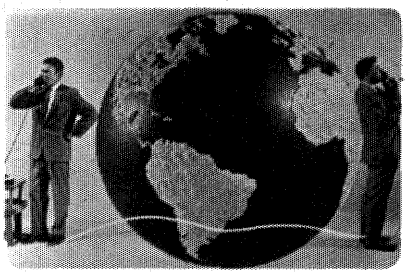
"We force air between them, and they vibrate."



"We shape the sound with our lips and tongues to form words."

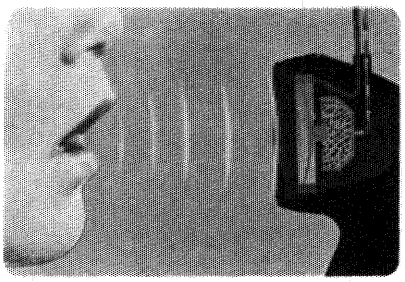


"Sound waves get weaker the longer they have to travel."

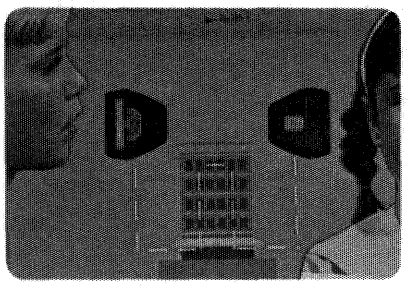


"But the telephone can send your voice around the world instantly."

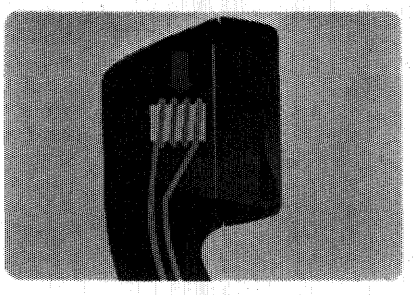
"Sound waves of your voice enter the telephone transmitter."



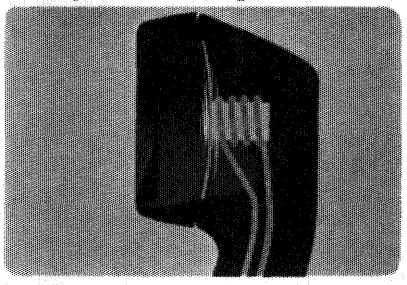
"The waves affect the electricity so it carries the pattern of your voice through the wire . . ."



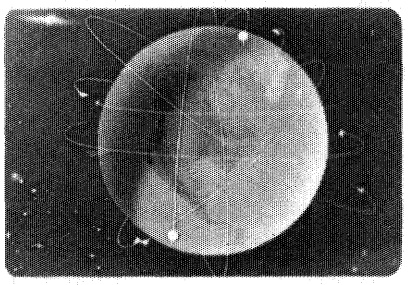
". . . And on to your friend's telephone receiver."



"An electromagnet becomes a magnet only when electricity flows through it."



"Rapid changes in electricity cause the magnet to make the diaphragm vibrate."

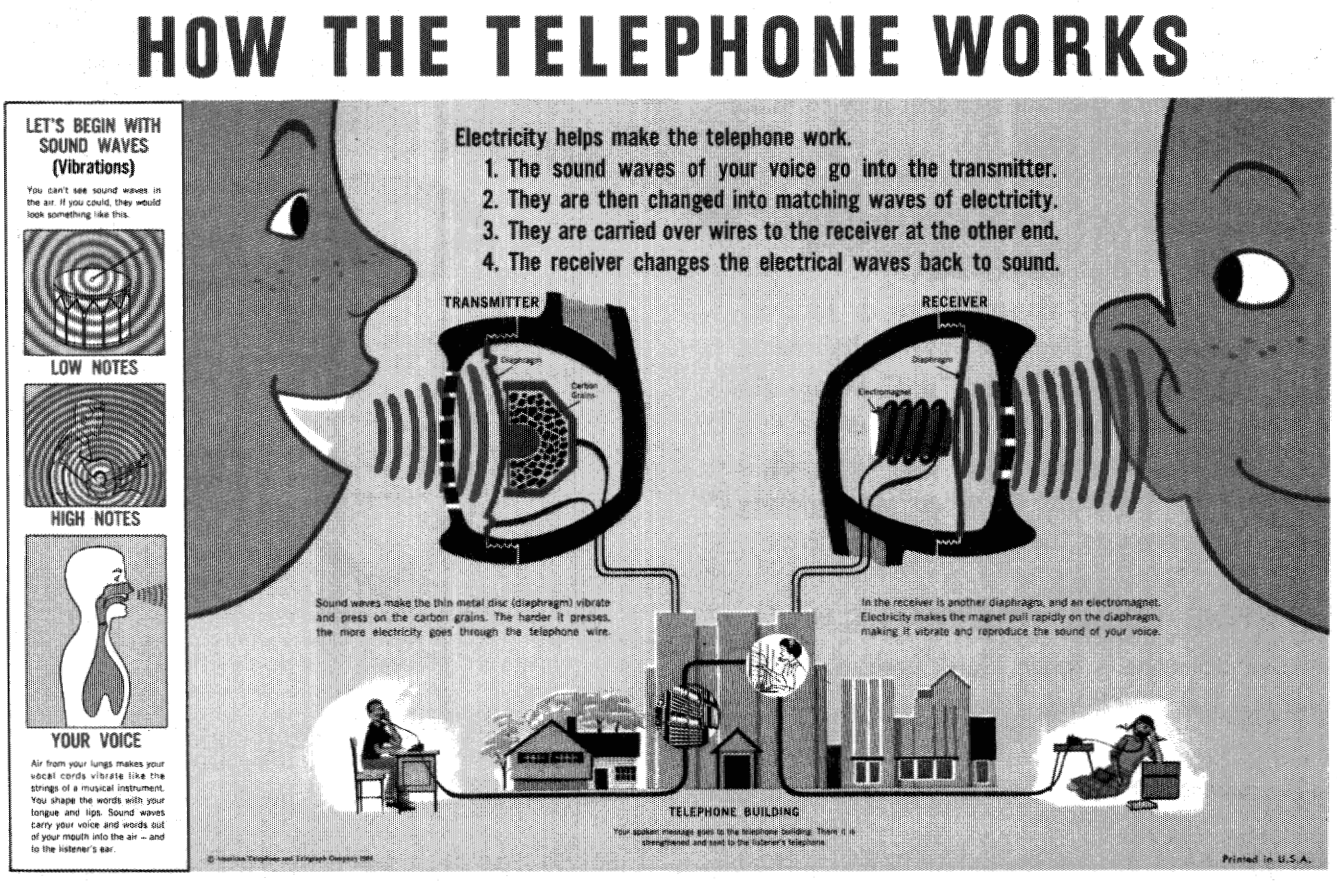


"Telephone calls can be relayed to different parts of the world by satellites."

SOUND AND THE TELEPHONE

This 24 x 36-inch wall chart presents basic information on the nature of sound and how the telephone works. It details how the telephone converts sound waves into electrical energy and electrical energy back into sound waves.

The wall chart reinforces information presented elsewhere in the program and makes the children more familiar with new words they have learned.



Additional Resources

Classroom Activities

LANGUAGE ARTS AND SOCIAL STUDIES ACTIVITIES

The following activities have been developed and used by teachers who assisted in the preparation of the Telezonia Program.

FOOTSTEPS TO MAKING A CALL

Arrange a pattern of footprints on the chalkboard or flannel board. Pupils suggest, in proper order, the things that should be done in making a call and write each of these on the appropriate footprint.

EMERGENCY CALLS

Before receiving any instruction, individual pupils tell the class how they would use the telephone to get various kinds of help, and what they would say to the operator. Other children then suggest improvements, until they understand how to make the call correctly (see page 21).

DEMONSTRATIONS AND CRITIQUES OF CALLS

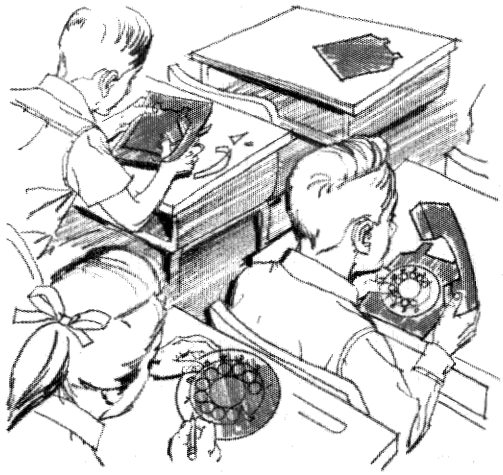
Each group decides on an important or interesting call to make and decides how to handle it. Two members then present the "skit" before the class. Classmates evaluate the performance. (At a previous session, the entire class may draw up a list of things they should do when participating in a call. This serves as the critique check list.)

TELEPHONE STORY GUESSING GAME

Prepare in advance a large chart with a simple story about the telephone (the invention, different telephone instruments, various uses). Cover several key words. Have the class read the story aloud, and ask individual pupils to guess the missing words.

A DEMONSTRATION WITH THE TELEPHONE

This activity shows why it is important to hold the transmitter directly in front of the mouth, and only about an inch or so away from the mouth, when speaking into it. Have two children sit across the room from each other with working practice telephones. While the listener watches, the speaker counts "1, 2, 3, 4" repeatedly while slowly lowering the transmitter away from the proper position and down toward the chin. Surprisingly soon the words become difficult if not impossible to hear.



CARDBOARD TELEPHONES

Supply each pupil with cardboard printed with silhouette shapes of the telephone base, handset and dial. Have them cut out, color, assemble and fill in letters and numbers on the dial. The activity reinforces letter and number recognition.

PUPILS IN ALPHABETICAL ORDER

Pupils find their proper alphabetical place in line with their classmates. Each then writes his name, last name first, in proper order on the chalkboard and in each pupil's personal number list at the back of the booklet, "We Learn About The Telephone." Addresses and telephone numbers can then be added.

PASSWORD

Two groups are formed and each selects a leader. The two leaders agree privately on a new or unfamiliar word learned from the unit. Alternately each leader gives his group a clue to help them discover the word. The group that guesses first wins the round. Score for the round depends on how many clues the group needs. If they guess the word after the first clue, the score is 10. The score diminishes by one point with each additional clue the leader gives.

PUPPET PLAYS

Children in each group decide what aspect of communications they will work with (how to use the telephone, telephone workers, important telephone calls, incidents in the history of communications). Each group makes its own puppets, writes the script, presents its own show on a stage cut from a cardboard carton and resembling a television set.

INSTALLER'S VISIT

A COMMUNITY HELPER IN COMMUNICATIONS

In many communities you can arrange for a telephone installer to visit the school with his truck and equipment. He shows the pupils the importance of safety and neatness in his job, explains the use of his equipment, and shows how he climbs a pole and connects the school's telephones to the telephone network.

The visit is an impressive and enjoyable experience for the children.

Ask your telephone company representative for details, or inquire at your local telephone office.

COMMUNICATIONS TIME LINE

Mark off a long string or cord in sections representing centuries. Color each section differently. Indicate various methods of communication and inventions at appropriate places to show how comparatively recent most communications progress has been.

COMMUNICATIONS BOOK

Each group decides what kind of pictures on communications to draw (different communications methods, Alexander Graham Bell inventing the telephone, things we use the telephone for, telephone courtesy, community helpers using telephone, a satellite). Each pupil draws a picture related to his group's topic. The class posts the pictures and discusses how they can be put in a sequence as a story. An appropriate sentence or two is then written on each picture, or on a separate page, and all the pictures are combined into a single story. Bind the collection as a booklet.

CORKBOARD TELEPHONE AND COMMUNITY NEIGHBORS

Make a large colored cardboard telephone with a rotating dial and hang it in the center of a corkboard. Have the children make "community neighbors'" hats (worn by policeman, postman, fireman, doctor, businessman, others). They place these around the telephone, along with several boys' and girls' hats. Have them place a small, original statement beside the appropriate hat; such as, "If you are lost, call me" for the policeman, or "Call me please, but don't talk too long" for a friend's hat. Black yarn is strung loosely from the telephone to each hat. At the edge of the board, hang a single red yarn cord with clips on either end. This is the busy line. When the children use the practice telephones, they announce with whom they wish to speak by clipping one end of the red cord to the big telephone and the other to the appropriate hat.

HISTORY OF LANGUAGE

Separate pupils into teams. Have them plan and present skits, songs, dances, costumes, mock-ups, charts, journals and reports about communications from cave man to modern man . . . and on to future man.

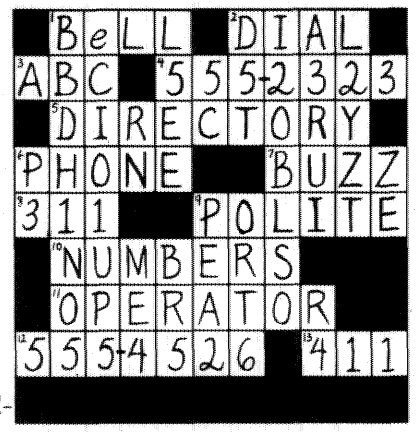
WHY THE TELEPHONE IS IMPORTANT

The class discusses why the telephone is important to everyone, then why it is specifically important to father and mother (while at home, while at work), sister or brother, storekeepers, movie theaters, doctors, firemen, repairmen, and others.

ACROSTICS

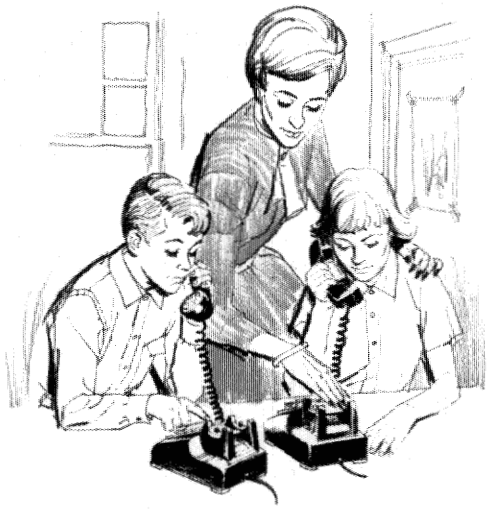
Develop a crossword puzzle, or a simplified puzzle with words going only in one direction. The pupils determine the words from the definitions.

1. Invented the telephone
2. Know your number before you —
3. Alphabet
4. Police number
5. Telephone book
6. Another word for Telephone
7. Busy signal
8. Our Area Code
9. Kindness
10. In the telephone book you find names and Telephone
11. In case of emergency call —
12. Fire Department
13. For local information call —



SCHOOL PARTY

A school party is planned with the student party committee doing all the inviting and arranging over the telephone.



REPORTS ON STATES AND COUNTRIES

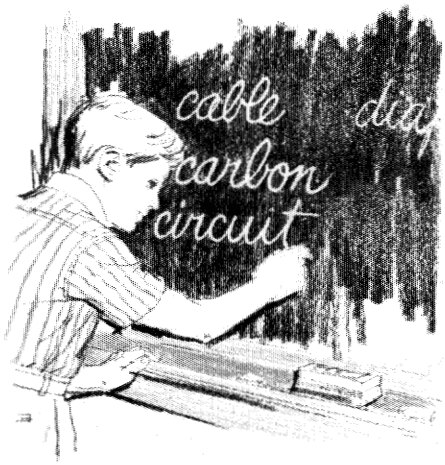
Divide class into groups, and assign each a major report on a country or distant state. The reports are spaced throughout the year, and much publicity is given the event, including invitations to the principal, supervisors and parents. Stress that language and communication are necessary inclusions in each report, including how we can communicate with the country or state (underseas cables, radio, television, satellites). Ask them to determine charges for a telephone call to the place. Using practice telephones, set up simple international problems or situations to be handled by telephone.

INSTALLER'S VISIT ACTIVITIES

Have pupils draw pictures of the installer's visit to the school and enclose them with thank you letters to the installer. Ask them to write the installer about the part of the visit they liked best, and what they learned from the visit.

COMMUNICATIONS OR TELEPHONE DICTIONARY

Pupils suggest new and unfamiliar words presented by the unit. The class then puts the list in alphabetical order and provides definitions.



CHILDREN'S QUESTIONS FOR DISCUSSION

- Why do people talk on the telephone?
- What kinds of telephones are there?
- How do you place a telephone call?
- What is the correct way to dial?
- How should you hold the handset?
- Why do you have to pay to make some telephones work?
- What do you do if you don't know the number you want to call?
- How do you use the telephone directory?
- What do you do if you can't get the number you call?
- What are some of the most distant places in the world that can be reached by telephone?
- Why did Mr. Bell invent the telephone?
- Who helps us make telephone calls?

OTHER ACTIVITIES

- Give oral reports on telephone experiences; past, present and future methods of communications; how to get help in an emergency, how alphabetizing helps us find information.
- Prepare original skits on correct telephone usage for classroom presentation.
- Write two or three sentence reactions to the film and filmstrips.
- Record in the Personal Number list in the pupil's booklet the name and telephone numbers of various community helpers.
- Describe and demonstrate the correct way to hold a receiver, dial a call, take a message, use a coin telephone.
- Talk about long distance and area codes.
- Learn how community helpers and businesses are listed in the Yellow Pages.

Classroom Activities

SCIENCE

MATERIALS REQUIRED

- Rubber bands
- Household cement
- Paper clips
- Flashlight cells
- Tin cans (soft drink type is thin and works well; do not use aluminum cans)
- Aluminum pie or TV dinner plates
- Water tumbler (thin-walled)
- Balloons
- Mirror chip
- Flashlight (penlight)
- Bar magnet
- Wrapping paper
- 3/8" x 2" stove bolt
- Magnet wire (#26 enameled)
- Hook-up wire (#24 or #28)
- Large pan or plate

HOW SOUND IS GENERATED

Sound is caused by vibrations, as shown by this demonstration.

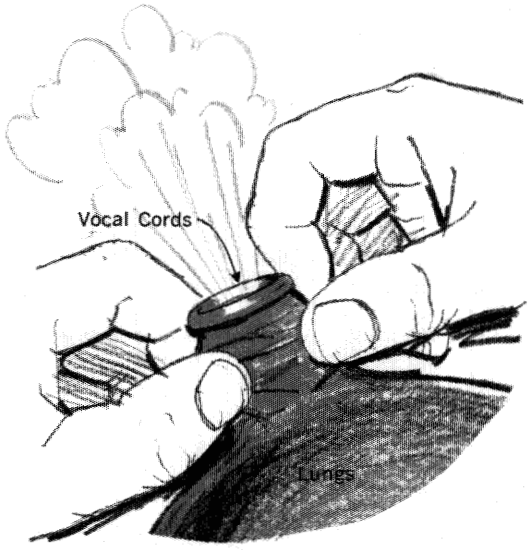
Let a student stretch a rubber band between the thumbs and forefingers of his hands. Let a second student pluck the strands of the stretched band. Note that the vibrations of the band, which can be seen, produce a humming sound. Increasing and decreasing the tension of the band will change the pitch of the sound.

Conversely, when vibration is suppressed, sound is also suppressed.

Lightly tap a thin-walled water tumbler with the eraser of a pencil. A clear ringing sound is heard. Now have a pupil cover as much of the tumbler as possible with his hands. The wall of the tumbler is no longer free to vibrate. Tapping the tumbler with the pencil eraser will produce at most a feeble click.

HOW VOCAL CORDS PRODUCE SOUND

Talking is also the result of vibrations, as the children can feel by gently placing their fingertips on their throats when loudly talking or singing. The vibrations are caused by the passage of air between the *vocal cords*, which act much like the stretched rubber band. These cords are suspended within a bony box in the throat, the *larynx*. Muscles of the larynx increase or decrease the tension of the cords to change our voice pitch.



The action of the vocal cords is demonstrated by means of a common balloon. The *inflated balloon* becomes analogous to our air-filled lungs while its thickened mouth becomes a model of our vocal cords.

Inflate the balloon. Stretch the mouth between the thumbs and forefingers until it is tightly closed. Now relax the tension until air escapes. The mouth will vibrate and produce sound. The pitch of the sound can be varied by changing the tension of the stretched mouth.

HOW VOCAL CAVITIES CHANGE SOUNDS

Scientists call the vocal cords the "buzz source" because they generate the raw vibrations. The nose and mouth cavities resonate the raw buzz into word sounds and the lips and tongue shape the syllables.

Have a student hold various length mailing tubes over the mouth of the vibrating balloon. A long tube resonates the sound at one frequency while a short tube resonates it at another. The action of the tubes simulates the action of the nose and mouth cavities.

HOW SOUND TRAVELS

Explain that the children can talk to each other only because sound travels, in waves, from the speaker's lips through the air to the listener's ears. These waves cannot be seen because the molecules of air they disturb cannot be seen. However, a comparable disturbance can be demonstrated in another medium — water.

Fill a large plate or pan with water. When the surface is quite still, drop a small round object onto its very center. The water molecules are disturbed at the point of impact. This disturbance passes from water molecule to molecule and travels outward in the form of a circular, visible *wave*. Sound, too, travels in the form of a *wave*.

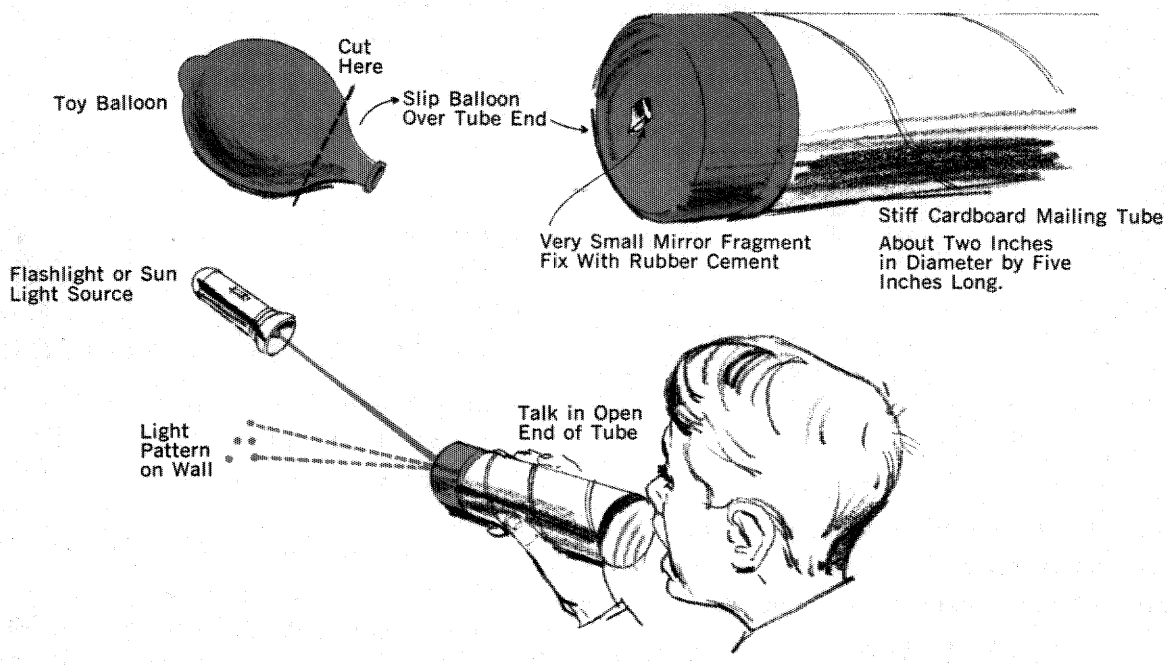
SOUND TRAVELS THROUGH SOLIDS

Have pupils, in turn, place their right ears on a wooden table top near a corner. Rap the far corner of the table with a ruler. The listening student will hear the sound coming through the wood of the table, and with the other ear he may be able to discern the sound coming through the air. The sound may be louder through the table because of the close contact with the ear.

DETECTING SOUND WAVES

Many devices will detect the disturbances or waves in the air caused by sound, like the window that rattles when a very loud low note is sounded by the radio or like the telephone transmitter that catches the sound of our voice and sends its replica over wires. The children can devise simple devices that will detect sound waves.

Have the pupils, in turn, hold a *thin* aluminum plate vertically about ten inches from their mouths. As they loudly sing or shout, they will feel vibrations in the plate. The waves or disturbances caused by sound create a varying air pressure on the near side of the plate.



Homemade "Oscilloscope"

Another demonstration is provided by the homemade "oscilloscope" (above). This device detects the waves and shows their change in strength, shape and frequency.

Hold the "oscilloscope" so that a direct sunlight or flashlight beam is trained on the reflector and projected as a spot on a darkened wall. Have a student voice vowel sounds into the tube. Different patterns of light will be traced on the wall for each different sound. The vibrating diaphragm, following the changes in air pressure caused by the sounds, controls the patterns.

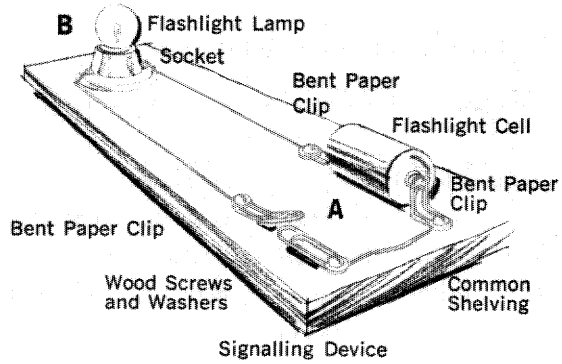
The eardrum detects sound waves in the same way the aluminum plate or the "oscilloscope" diaphragm does – by vibrating in response to the sound. When this happens, the disturbance is carried through a set of small bones to a set of nerves which enter the brain. We perceive the sensation we call sound.

HOW THE TELEPHONE WORKS

The telephone extends the range of voice communication by converting sound waves to electrical waves which can be guided over a single narrow path from one distant point to another.

After assembling the simple circuit illustrated below, have a student momentarily force the paper clips together at point "A" so that the lamp at "B" flashes. Finger pressure "sends" an electrical *pulse* over the wires. This *pulse* or wave can be "seen" in the illumination of the lamp. Here a mechanical pressure directed by the human brain is converted into an electrical wave which travels over wires. Then the electrical wave is reconverted into a sense stimulus to be received by the human brain.

Since the lamp flash at "B" is under complete control of the pressure applied at "A," the flashes may be coded. For example, let a single, long flash mean *no* and two rapid flashes mean *yes*. Have one student question a second who answers by flashing the lamp. Here, then, *information* is being passed from "A" to "B" by means of electrical waves. This conversion from brain-directed information to electrical waves to brain-perceived



information is the basis of all electrical communication systems – radio broadcasting, telegraph, television and the telephone.

HOW THE TELEPHONE RECEIVER WORKS

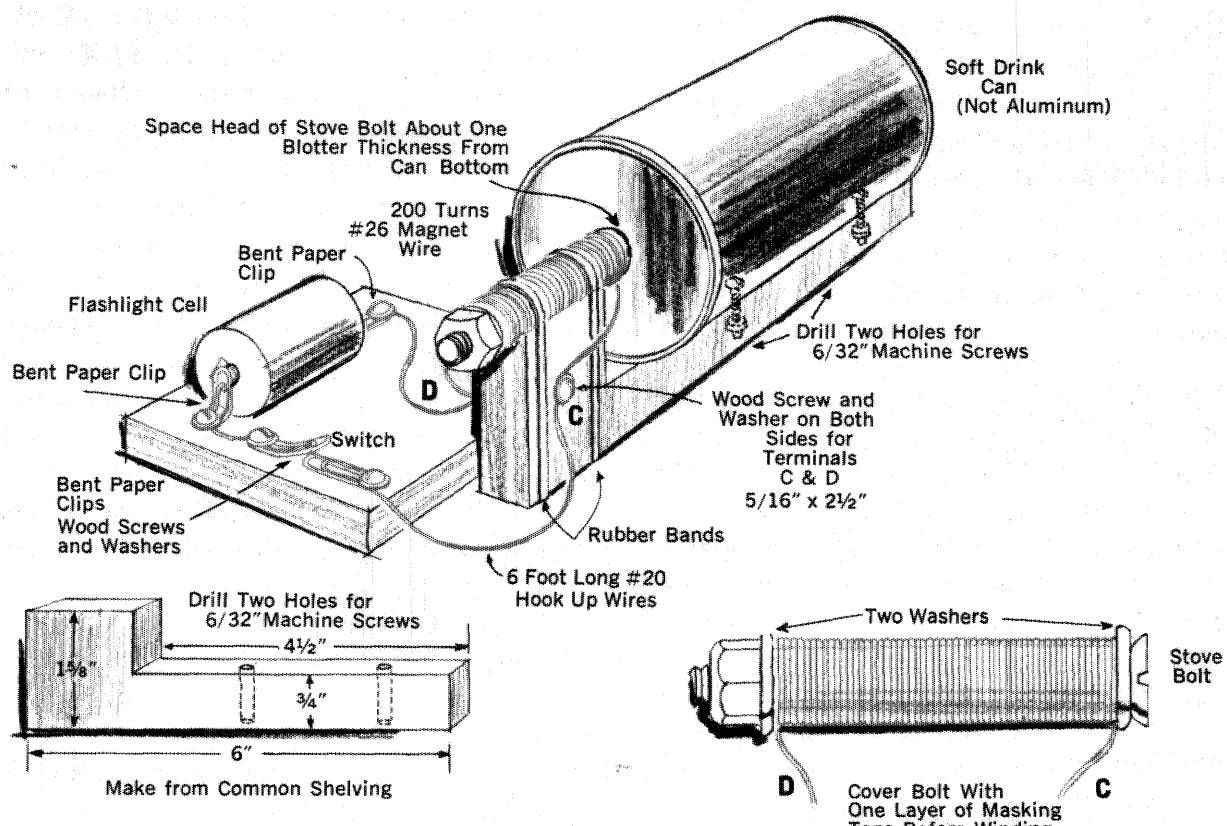
If the bottom of a tin can is tapped, sound is created because the bottom vibrates and disturbs the surrounding air. It is possible to make the bottom of the can vibrate without touching it in the following fashion:

Bring a *bar magnet* near the bottom of a soft-drink can. Pupils can feel that the magnet attracts the bottom of the can and makes it move. Very little sound will be produced because the movement of the can bottom is very slow.

The can bottom can be made to move faster under the pull of a magnet by replacing the bar magnet with an *electromagnet*. Then the magnetizing force (which pulls the bottom of the can) can be turned *on* and *off* very rapidly. An electromagnet is simply a coil of wire through which an electric current is passing, creating a magnetic force. The force is greatest if the coil of wire is wound on an iron rod, because iron is a better conductor of magnetic force than is air. To show how the electromagnet can excite the bottom of the can to create sound, make up the demonstration unit shown below.

Close the switch by pressure from your finger. You will hear a click. When the switch is closed, current through the coil rapidly changes the assembly to an electromagnet which attracts the can bottom. Release the switch. Electricity ceases to flow and the electromagnet rapidly loses magnetism. The can bottom returns to its normal position to produce a second click.

The can bottom acts exactly like the diaphragm in a telephone receiver. It converts electrical pulses or waves to sound waves. If electrical waves, converted from the sound waves of your voice, were connected to the coil of the electromagnet, the can bottom (diaphragm) would follow these waves and reproduce the spoken words.



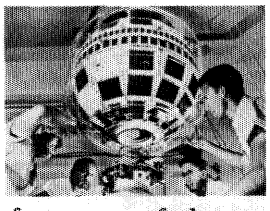
Receiver

Resources

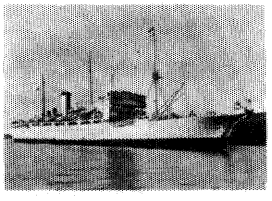
FILMS

The following films are available for lower elementary use. They were produced for general public audiences; therefore, educators who reviewed them recommend that you prepare your classes by advance discussion and explanation of the content. You may borrow them from telephone company representatives or from local Bell Telephone offices in most areas.

MR. BELL: (16-minute, 16mm. film) An action portrait of Alexander Graham Bell as he looked, talked and thought. Several sequences show Bell as a teacher of the deaf. The similarity between the human ear and his telephonic instruments is demonstrated. Also shown are the events leading up to the invention of the telephone, ending with the dramatic scene where Watson hears Bell's words on the telephone for the first time.



PROJECT TELSTAR: (14-minute, 16mm. color film) This tells the history-making story of the successful launching and performance of the world's first active communications satellite. The film deals with the dramatic, on-the-scene story of the development stages and launching of Telstar and the transmission of signals by the satellite.



THE VOICE BENEATH THE SEA: (13-minute 16mm. color film) This traces the establishment of the first telephone cable link beneath the Atlantic from North America to the British Isles and Europe. Shown is the *H.M.T.S. Monarch* on the high seas during cable laying operations. Through animated sequences the film explains voice carrier, cables, radio relay and short-wave radio-telephone service overseas.

MAKING CONVERSATION: (12½-minute 16mm. color film) This is the story of how the telephone is manufactured and its role in the American community. The film shows how basic raw materials are transformed into almost 500 separate parts needed to make each telephone. The last sequence shows how the telephone is used throughout the country to bring people together.

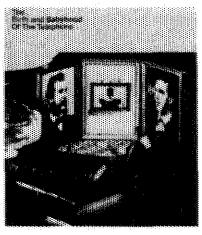
BOOKLETS

The following booklets are suggested —

- As resource material for the teacher
- For selected reading to the class
- For classroom library

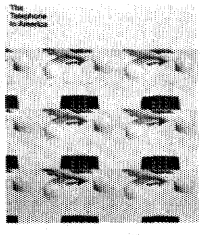
They were written for upper elementary or junior high school students, and are therefore not recommended for distribution to lower elementary classes on a one-per-student basis. They are available from telephone company representatives or from local Bell Telephone offices.

ALEXANDER GRAHAM BELL: Provides a concise biography of Mr. Bell, describing his early research and experiments in the fields of speech and sound which ultimately led to the birth of the telephone. Mr. Bell's pioneering efforts in fields other than communications are also covered.

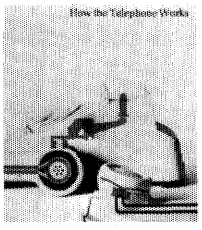


THE BIRTH AND BABYHOOD OF THE TELEPHONE: Offers a factual account of not only the invention and early days of the telephone, but also many of the events leading up to this important occasion.

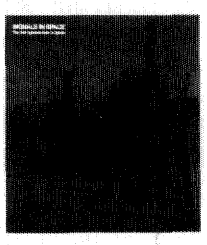
THE TELEPHONE AT YOUR COMMAND: This illustrated booklet explains in detail the development of telephone switching equipment. It deals with the early problems of interconnecting telephones, to crossbar switching equipment which is used in many central offices, and includes the newest method—electronic switching systems.



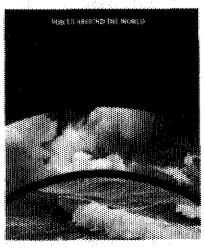
THE TELEPHONE IN AMERICA: An illustrated booklet describing the history of the Bell System, its organization, its growth as a business, and the role it will play in future telephone communications.



HOW THE TELEPHONE WORKS: A simplified explanation of how the telephone works. The illustrations and text explain the many intricate parts of a telephone, as well as how a telephone call is placed, switched, and completed.



SIGNALS IN SPACE: Tells the story of the Bell System's role in space including the pioneering work done in radio astronomy, development of the transistor, solar cell, the Echo and Telstar communications satellite experiments, the ground communications used in the manned space program, the work of Bellcomm and the Bell System proposal for a domestic satellite system.



VOICES AROUND THE WORLD: Tells the story of man's historic quest to find better ways to communicate and of the great discoveries that have made voice highways to people in other lands a reality.

THE LIFE OF ALEXANDER GRAHAM BELL

by Elizabeth Enright

Almost everybody knows that Alexander Graham Bell invented the telephone; but how many people know that he invented the wax-disc phonograph record, the fastest motor boat in the world for its time, and an electrical probe for surgeons? That he developed a breed of sheep that the farmers said was impossible? How many people know that really it was because of him that Helen Keller learned to speak? And these are only a few of his great accomplishments.

Born in Edinburgh on March 3, 1847, he was the youngest of three Alexanders. His grandfather for whom he was named was plain Alexander Bell; next there was his father Alexander Melville Bell; and then there was himself, plain Alexander Bell again.

This was a lot of Alexander Bells and while he was still quite young, the boy was allowed to choose a second name for himself. The name he chose was Graham, in honor of a friend of his father's whom he liked. In his childhood and throughout his life, he liked to be called Graham.

All the Alexanders in the Bell family had a great interest in the perfecting and training of the human voice. Graham's father was a talented man whose great contribution was what he called "visible speech," a method of teaching deaf people to speak, which is still in use.

His inventive genius had begun to show itself when, at the age of fourteen, Graham and his brothers had outfitted a model skull with a reproduction of the human vocal process. It was worked with a bellows, and bleated "Ma-Ma" so convincingly that neighbors hearing it thought it was a neglected baby.

But though he was remarkably gifted, he was at first a very poor student so his father decided it was time to treat young Graham to a year of hard, no-nonsense study with his grandfather in London. It was a year of work, indeed, and of wearing fancy clothes, which he disliked; but during it he really learned to study, and enjoyed it. His grandfather, discovering that he was a talented pianist, gave him an excellent training in music.

Graham's mother played the piano beautifully, too, but tragically for her was the loss of her hearing; she could not even hear the notes she played. This had a deep effect on her young son, who knew more about deafness than most people; and it was, perhaps, one reason why he was to become such a dedicated teacher of the "Visible Speech" method.

He began teaching in Boston, at the age of twenty-four. He was very successful and decided to settle in the United States. When he wasn't teaching, he was experimenting with electricity.

Perhaps it is no wonder that he, with his gifts and training should finally have been the one to conceive the idea of the telephone. From his father and grandfather he had learned everything possible about speech and the production of voice sounds. He was intensely interested in ways to use electricity, and intensely interested in communication. Possibly his sympathy with deaf people heightened this, for he knew many and they were important to him. There were his students; there was his mother; and finally there was the girl he fell in love with, Mabel Gardiner Hubbard, his pupil, who had been totally deaf since she was four years old.

Elizabeth Enright has written eleven children's books including the best-selling "Melendy" Family series, the "Gone Away Lake" books and "Thimble Summer" which won the coveted Newberry Award. She has also written numerous adult short stories.

He worked and experimented for a long time with Thomas A. Watson, a highly skilled young electrician; and at last, on June 2, 1875, after countless tests with the "harmonic telegraph" the breakthrough was made that resulted in the telephone.

At first the instrument would carry sound, but the words were not clear. A year later, after Graham had his first patent, he and young Watson tried out a new transmitter. Watson went to the other end of the line, in Graham's bedroom, picked up the receiver and nearly dropped it when he heard Graham's voice saying clearly: "Mr. Watson, come here, I want you!"

And that was the beginning: a wonder of the world. It astounded everyone, from the Emperor of Brazil to Queen Victoria of England, and it was hard to believe that someday, in thousands of houses in nearly all the countries of the world, people would be talking to each other. Sometimes at great distances – by means of this strange device.

That was the first and most famous of Graham Bell's inventions; he never stopped and his accomplishments went on and on. Perhaps one of the most satisfying of these was the fact that he was able to help a desperate little creature, blind and deaf and speechless.

Helen Keller was six and a half years old when she was brought to him. She was wild, like a little animal; but when Graham held her close she put her arm around his neck knowing, as she said later, that she found her first friend.

Years later it was Graham Bell who was instrumental in getting Helen to Radcliffe College, and they remained fast friends as long as he lived. Helen said: "When he found me, I was like a ship without a compass or a sounding line, lost in a dense fog."

He was the kindest and most humane of men, and he used his life, all of it, every minute. He liked to work at night, when the house and the world were very still. His wife Mabel once told him she was painting his portrait, and then gave him the picture of an owl.

The stiller it was, the better he liked it, and he took pains to swaddle all the clocks with towels so he couldn't hear the ticking. His daughters were delighted one morning to find a particular clock bundled up to its ears. *That* clock hadn't run for a year.

Alexander Graham Bell

His daughters adored him, and he loved them dearly, but most of all he loved his wife, Mabel; and their marriage was a long and happy one. In winter they lived in Washington, but in summer they went to Baddeck, in Nova Scotia, which they considered the most beautiful spot in the world. There he raised sheep; he flew his huge experimental kites; he ran his powerful boats on the waters of the *Bras d'Or;* he climbed the mountains, and swam in the lakes, and went out in storms wearing a bathing suit.

But always he had time to think his thoughts; to plan, to experiment and innovate. He had time, always, for his beloved family, as well as for the afflicted people who needed his help.

Altogether, Graham lived his life to his fingertips. His work brought him joy and honor and fame and wealth; but the tablet on his grave in Nova Scotia says only this: "Alexander Graham Bell, inventor, born March 3, 1847, died a Citizen of the United States, August 2, 1922."

WHAT THE TELEPHONE IS MADE OF

Altogether, nearly 500 parts – from the outer molded plastic housing to the smallest screw – are in the modern telephone. Of these, 75 parts are in the handpiece. These parts are made of 62 different materials which come from all over the world. In a sense, the telephone is a United Nations of materials.

When you handle a telephone, you are touching materials that were mined, grown or made by an Indian in Peru, a native of Indonesia, a citizen of a newly-independent nation in Africa, or perhaps even by a relative in the United States.

Here are some of the many materials the telephone is made of:

Material	Use in the Telephone	Source Locations
Aluminum	Dial gear frame, transmitter diaphragm, receiver dome	United States, British Guiana, Dutch Guiana, Jamaica
Asphalt	Sealer for receiver assembly	United States, Venezuela, British West Indies
Beryllium	Dial clutch band	Brazil, Argentina, India, South Africa, Australia
Carbon (Anthracite Coal)	Granules in transmitter	United States
Chromium	Receiver coil frame, dial gears, finger stop	Turkey, South Africa
Cobalt	Receiver magnet and armature	Republic of Congo, Canada
Copper	Wire and leads in all components, gongs and clapper	United States
Cotton	Wire insulation, handset acoustic barrier	United States
Gold	Transmitter dome and electrode plating	United States, Canada, South Africa, Australia
Lacquer	Paint for base plate, network capacitor coating, wire insulation	United States
Lead	Solder	United States, Mexico
Molybdenum	Receiver coil frame	United States
Nickel	Springs, ringer magnet, contacts, dial clamp plate	Canada, Norway
Nylon	Dial pawl and cam	United States
Palladium	Contacts	Canada, South Africa
Paper (Wood Pulp)	Subscriber number plate	Canada, Sweden
Phosphorus	Dial plates, springs	United States
Plastics	Telephone housing, handset handle, component hardware	United States
Rayon	Receiver acoustic screen, washer in transmitter	United States
Rubber	Gear and governor studs in dial, switch-hook assembly	Indonesia, Malaya
Silicon	Network and ringer cores	United States
Silver	Plating on transmitter cup, springs	United States, Canada, Peru, Mexico
Steel (Iron Ore)	Base plate, network case, ringer magnet and frame, switch-hook, component hardware	United States
Tin	Solder	Indonesia, Malaya
Vanadium	Receiver armature	United States
Wax	Network capacitor insulation	United States
Zinc	Dial, transmitter and receiver frames	United States

IMPORTANT EVENTS IN COMMUNICATIONS HISTORY

Mar. 10, 1876	The first complete sentence of speech transmitted by telephone in Boston.
Jan. 28, 1878	The first commercial telephone exchange in the world opened at New Haven, Connecticut.
Nov. 3, 1892	The first "Dial" telephone office in the world was opened at La Porte, Indiana.
Jan. 25, 1915	The first transcontinental telephone line from New York to San Francisco (3,600 miles) was opened for service.
Oct. 21, 1915	The first transmission of speech across the Atlantic was achieved.
Jan. 4, 1923	Radio networks began with hookup of two broadcasting stations connected by long distance telephone lines.
April 7, 1927	The first public demonstration of television was given by Bell System engineers.
Dec. 8, 1929	Commercial ship-to-shore telephone service began.
May 21, 1940	A television program was transmitted over telephone lines in a New York-Philadelphia demonstration.
Nov. 10, 1951	Direct Distance Dialing by telephone users began at Englewood, New Jersey.
Sept. 25, 1956	First transatlantic telephone cable opened for service.
Aug. 3, 1960	A coast-to-coast telephone conversation was made by bouncing voices off the moon.
July 10, 1962	World's first active communications satellite, Project Telstar, launched into orbit.
April 1, 1964	Picturephone service demonstrated to public at New York World's Fair. First transcontinental Picturephone call made from New York World's Fair to Disneyland in Anaheim, California.

COUNTRIES AND THEIR TELEPHONES

Country	Approximate Number of Telephones in Service	Country	Approximate Number of Telephones in Service
Argentina	1,500,000	Mexico	600,000
Australia	2,500,000	Netherlands	2,000,000
Canada	6,500,000	Spain	2,000,000
France	5,000,000	Sweden	3,000,000
Germany, Fed. Rep.	7,000,000	Switzerland	2,000,000
India	600,000	U. S. S. R.	6,000,000
Italy	5,000,000	United Kingdom	9,000,000
Japan	7,500,000	United States	85,000,000

DIRECT DISTANCE DIALING AND INTERNATIONAL DIALING

Increasingly since 1951, people have been able to dial their own long distance calls throughout the United States and Canada. To make this possible, the two countries have been divided into telephone areas, each with its own three-digit area code. No two telephones have the same number in an area.

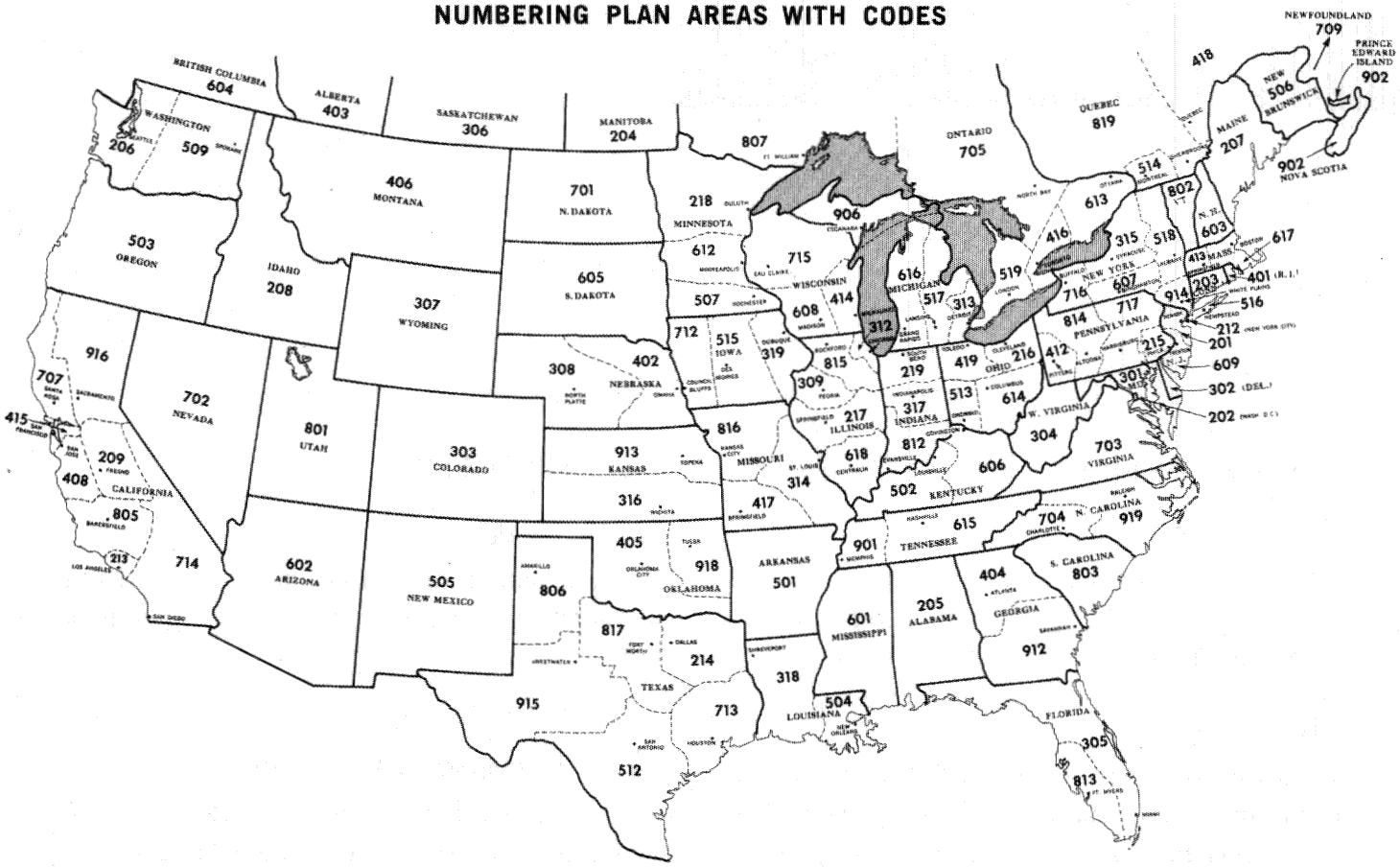
Here is what happens when you dial a number like Area Code 311 555-2368.

In effect, when you dial the area code 311, your telephone is connected to switching equipment serving that area. Dialing the next three digits 555, connects you to a local telephone exchange in the community you want. Dialing the last four digits rings the telephone of the person to whom you want to speak.

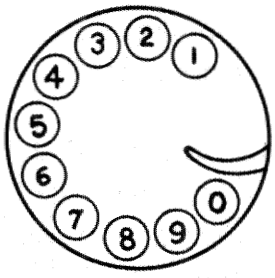
While customers dial many calls in this fashion, telephone operators handle all calls requiring special assistance.

Plans are now being made so people can dial directly to telephones in Europe. Telephone operators in some cities can do this already.

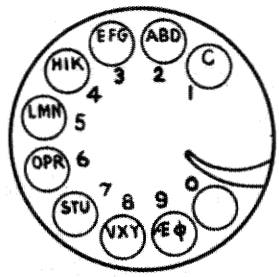
NUMBERING PLAN AREAS WITH CODES



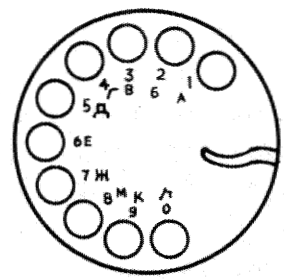
TELEPHONE DIALS OF OTHER COUNTRIES



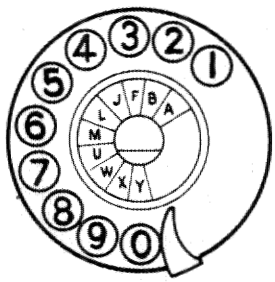
GERMANY



DENMARK

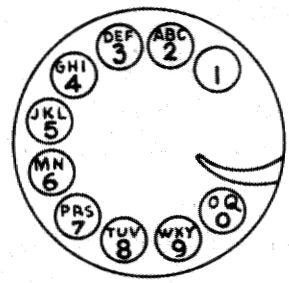


U.S.S.R.



AUSTRALIA

ENGLAND



FRANCE

Filmstrip Narration

"HOW WE USE THE TELEPHONE"

Introduction:

I'm going to start today by showing you some different kinds of devices that people use. I want you to tell me what they are.

1. *(no caption)*

It's a bus, of course – the kind that takes children like you to and from school each day. The driver has to be a *good* driver to get children to school on time and safely home again. Let's try the next one.

2. *(no caption)*

A telescope is right. With this wonderful invention, man can see the moon close up – unlock the secrets of the stars! But only because he has learned how to make the telescope work. Let's try another one.

3. *(no caption)*

Yes, the cockpit of an airplane. Look at all those dials on the instrument panel! The pilot must know how to read them all. His machine can do wonderful things. It can carry him great distances at amazing speeds. But only if he knows the *right way to use it*. That's true of all three things we've just looked at. They're not of much use unless people know the right way to use them. Now here's an invention *we* can use. Everyone will know what this is!

4. *(no caption)*

This instrument can carry your voice all the way across the country. And do it quick as a flash!

5. **The Telephone: Many Uses**

The telephone has many uses. It can make friends for you, bring quick help in emergencies. Now, we've all used the telephone. But we must make sure we're using it correctly – or it won't *perform* properly. Let's see if we can become expert telephone users. Let's begin with the first step. What's the first thing you need before making a telephone call?

6. **Telephone Number**

Right! The telephone number. This boy wants to call his friend, Bobby Martin. But he isn't sure what the number is. Anybody know what he should do?

7. **Look It Up**

Yes . . . look it up in the telephone directory. The directory has the names, addresses and numbers of the people in the community who have telephones. If the number you look up is one you call often . . .

8. **List Personal Numbers**

. . . write it down on your own list of personal numbers. This is where you keep the numbers of your friends. It's much quicker to find a number on your list than in the big directory.

9. **Write Numbers Down**

Write numbers down that you look up in the directory. If it's not a number that you call often, use a scrap of paper – but be sure to write it down before you close the directory. Otherwise, you may forget it and have to look it up all over again. We have our number now – what's the next step?

10. **Listen For Dial Tone**

It's important to listen for dial tone before dialing. Know what the dial tone sounds like? Come on, let's hear it. B-r-r-r. That's it – a steady hum. Of course, if we start dialing before we hear it, we won't get our number.

11. **Finger Firmly in Dial Hole**

When you dial, make sure your finger is firmly in the dial hole. And be sure you're dialing the right number. If the number you are calling is 555-3142 which would you dial first? (Pause) That's right! 5.

12. **Don't Dial "O" For "Zero"**

Don't dial the letter "O" when you want the numeral "Zero". Can you see which is which? Will somebody tell me which is the "Zero"? That's right, it's the last hole on the dial. You dial "Zero" when it occurs as part of a telephone number. You also dial "Zero" when you want the operator. See the word "Operator" next to "Zero"? Later, we'll tell you more about *when* to call the operator.

13. **Don't Dial "I" for "One"**

Don't dial "I" for "One". It's easy to be fooled by the letter "I" and the numeral "1". They look so much alike. Which is the numeral "1"? Anybody? Yes, it stands all alone . . . it's the first hole on the dial.

14. **Dial to the Finger Stop**

Dial each number all the way around to the finger stop. When you reach it . . .

15. **Remove Finger**

. . . remove your finger, and let the dial return to its original position. Do this for every numeral. If you make a mistake . . .

16. **Hang Up Gently**

. . . hang up gently, wait a moment, and start over again. Soon you'll be doing it as well as your parents! Sometimes when you call . . .

17. **Busy Signal**

. . . you'll hear the busy signal which means that the person you're calling is talking to somebody else. What does the busy signal sound like? B-z-z-z, B-z-z-z, B-z-z-z. Don't get angry when you hear this sound. After all, when *you're talking* on the telephone and somebody dials your number, he gets a busy signal, too. The thing to do is to hang up, wait a few minutes and then try the number again.

18. **Wrong Number**

And if you make a mistake and call the *wrong number,* apologize to the person at the other end before hanging up. This is the courteous thing to do. It will help you make friends – instead of enemies. This boy was calling a friend and got the beauty parlor by mistake.

19. **Wait Ten Rings**

Wait at least ten rings for someone to answer before hanging up. Sometimes, it takes people a while to get to the telephone. When you do speak to the person on the other end of the line . . .

20. **Tell Who You Are**

. . . tell him right away who you are and whom you are calling. (Pause) To make sure he understands you . . .

21. **Hold Receiver Like This**

. . . hold the receiver like this: The receiver snugly against your ear, the transmitter directly in front of your mouth.

22. **Use Normal Voice**

And use the same normal tone of voice you'd use if the person were in the same room with you. (Pause) Now, let's have some fun and go to the Telephone Zoo, where we will find out about things you shouldn't do with the telephone.

23. **Don't Roar**

Don't roar or shout – you might hurt the ear of the person on the other end. What you say won't be understood any better than the sounds an animal makes. Speak clearly and directly into the mouthpiece. Don't roar . . .

24. **Don't Mumble**

. . . but don't mumble either. If you talk with something in your mouth, you won't be understood. Say what you have to say clearly and pleasantly.

25. **Don't Hog The Phone**

It's selfish and impolite to "hog" the telephone. Somebody may be waiting to use it – or trying to call your house with an important message. Above all – treat the telephone with care . . .

26. **Don't Monkey With It**

. . . don't monkey with it when you use it! You just might put it out of order – then you couldn't call anyone! But what if someone calls *you*?

27. **Don't Be A Sleepy Bear**

Don't be as slow as sleepy bear when you hear the telephone ring. Answer it quickly. If you wait too long . . .

28. **Nobody There**

. . . there won't be anybody there. The other person will give up and *hang up*. Answer the telephone promptly, and . . .

29. **"Thomas Residence. This Is Mike"**

. . . like a smart human say: "Thomas residence. This is Mike." Always let the person know right away to whom he is speaking. If the person wants to speak to your Father . . .

30. **Call Him Promptly**

. . . be sure to call him promptly. It's impolite to make people wait. If the person the caller wants isn't there . . .

31. **Take A Message**

. . . take a message. Always write down whom the message is for, the name and number of the person who called, and sign your name. And, of course . . .

32. **Know Your Own Number**

. . . it's important to know your *own* number by heart, so that you can call home quickly when you have to ask your Mother something or tell her you'll be home later than expected.

33. **Emergency Calls**

But what if you had to make an emergency call? Suppose you want to report a fire – or an accident – or get the doctor to come quickly, how would you get help? Anybody know? (children respond)

34. **By Telephone**

That's right – you'd get help by telephone. First, pick up the receiver, remember to wait for the dial tone . . .

35. **Dial "0" For Operator**

. . . then dial "Zero" for the operator. Make sure you don't dial the letter "O" by mistake. See the "Zero"? It's the last numeral on the dial, and it says "Operator". Just dial "Zero" once and . . .

36. **She Will Connect You**

. . . she will connect you . . .

37. **Proper Emergency Help**

. . . with the proper emergency help.

38. **Tell Who, Where and Why**

Tell the person *who* you are, the address *where* you are and *why* you need help.

39. **Happy Ending**

The telephone has helped make a happy ending for many real-life stories.

40. *(no caption)*

If you treat it right, the telephone will be a good friend for life.

Filmstrip Narration

"THE ALPHABET WORKS FOR US"

1. Meet Sergeant ABC

Meet Sergeant ABC. He's going to make his alphabet army march on parade, and do some things for us. And he's going to give us the secrets of how to make the alphabet solve some puzzles for us.

2. Looking Things Up Is Easy!

Looking things up is easy! The sergeant is going to show you a quick, easy way to look information up in the encyclopedia, dictionary . . .

3. Let Me Help You

. . . or the telephone directory. The sergeant will help you look up the name and number of anybody listed in the telephone directory in a jiffy!

4. Look Up Numbers

You'll be able to look up numbers for your parents. They will be so impressed!

5. The Whole Town Is Here

Almost everyone in town can be found in the telephone directory. Your friends are in it.

6. Stores and Community Helpers, Too

Stores and community helpers your family use can be found here, too.

7. But How Do We Look Them Up?

But how do we look up their telephone numbers? This boy wants to find his friend Bobby Martin's telephone number. He knows that the number will be listed under the name of Bobby's father, Robert Martin. But when he opens the directory . . .

8. So Many Names!

. . . there are so many names! It seems impossible to find Robert Martin among so many thousands of names. Until we let the sergeant show us the secrets of the A B C's.

9. First: Alphabet Drill

First, we'll start with an alphabet drill. The sergeant is concerned because the letters are not in the right order. So he shouts: "Attention!"

10. Alphabet on Parade

Like at a parade, the letters line up in alphabetical order. A before B, B before C, and so forth.

11. Robert Martin, Forward!

Now the sergeant orders the letters to form the name of Robert Martin.

12. **Robert Martin, Attention!**

Robert Martin, Attention! But this isn't the way it would be listed in the telephone directory. Can anyone tell me what's wrong?

13. **Telephone Book Formation**

Telephone book formation always has the last name first. It's less confusing to list them that way. Robert is often called by his nickname, Bobby. But his *last* name always stays the same. Since his last name – Martin – begins with "M" . . .

14. **Martin Found Under "M's"**

. . . it will be found under the "M's" in the telephone directory. You'll find all sorts of names there from "A" to "Z". Remember, names are always listed in alphabetical order. Why is Martin listed after Lemus and before Norwood? Because "M" comes after "L" and before "N" in the alphabet. When you find the "M's" . . .

15. **Page Corner Has Names**

. . . look on the upper corner of the page. The name you're looking for may be shown there. But if it isn't, check the first few letters. For example, in this directory, *Mart* would be found between *Marlow* and *McAvoy*. So – you know that Robert Martin is on this page.

16. **Name, Address And Number**

Here's the name, address and telephone number – Robert Martin, 22 Montrose Street 555-2368. Of course, it's only listed here because his *father's* name is Robert Martin, too. Your friends will be listed under their parents' names.

17. **Before or After Robert?**

Would the name Raymond Martin come before or after Robert Martin in the telephone directory?

18. **"RA" Before "RO"**

Yes, *the last name,* Martin, stays the same, and both first names begin with "R". So we move to the next letter. Since "A" comes before "O" in the alphabet, "RA" comes before "RO" in the telephone directory.

19. **Raymond Before Robert**

"Raymond" will always come before "Robert" in the directory. Let's try another one.

20. **Before or After Robert**

What if his name were *Roger* Martin. Would that come before or after Robert?

21. **"G" Comes After "B"**

After is right – because "G" comes after "B". Now let's see what we've learned.

22. **Alphabetical Order**

(Teacher asks specific children.)
Why does "Raymond" come before "Robert" Martin? Why does "Robert" come before "Roger"? Why does "Rose" come last of all? Very good! So now we know how to find first names in the directory when the *last* name is the same.

23. **Different Last Names**

But what about different last names? What if the name we were looking for was Robert *Mayer?* Would it come before or after Robert *Martin?*

24. **"R" Before "Y"**

That's right! "R" comes before "Y" so Martin is listed before Mayer. Now let's see if Sergeant ABC can help us find Robert Mayer in the directory.

25. **First Find "M's", Then "May's"**

First, we find the corners that have names beginning with "M" on them. Then, under the "M's", we find the page where "May" would be. We look down the page alphabetically.

26. **Robert Mayer — Found in a Jiffy!**

And we find Robert Mayer in a jiffy! We find him listed right where he should be – between John Mahoney and Nicholas Mazzio.

27. **Happy Sergeant**

The sergeant is happy because you've caught on so quickly to his alphabet drill. But now that we know how to use the alphabet to find numbers in the directory . . .

28. **Write Number Down**

. . . let's be sure to write them down so we don't have to look them up again! Your Mother and Father probably keep their own personal number book where they write down the names and numbers they call often.

29. **Barclay Radio Repair**

Now suppose your Mother asked you to call Barclay Radio Repair shop to see when they could make needed repairs on the family radio. You would have to look up the number. Which letter would you look for first?

30. **"B" for Barclay**

That's right – "B" for Barclay. Now you look in the upper corner. Would it come before or after "Baran"? Right! "C" comes after "A" – and it comes before "T" – so you know you're on the right page. Then you look through all the Barclays . . .

31. **Alphabetically Listed**

. . . alphabetically until you find Barclay Radio Repair. Thats all there is to it!

32. **In An Emergency**

In an emergency – when speed is important – what do you do to get help?

33. **Dial "0" for Operator**

Just dial "Zero" and the operator will answer. Don't dial the letter "O" by mistake. "Zero" is the last numeral on the dial. Tell the operator why you need help. Remember, if you are reporting a fire, the most important thing is to get out of the building that is burning, and make the call nearby.

34. **Tell Her *Who, Where, Why***

Tell the operator *who* you are, the address *where* you are, and *why* emergency help is needed.

35. **She Will Connect You**

She will connect you to the proper help, whether it's the police, fire department or a doctor. But for most other situations . . .

36. **A Valuable Friend**

. . . the telephone directory will be a valuable friend. It will tell you in seconds how to reach almost everybody in the community.

37. **Dictionary Works the Same Way**

The dictionary works the same way as the telephone directory. Let's see!

38. **What Does It Mean?**

What does the word "communication" mean? Let's look it up in the dictionary. What letter do we look under?

39. **First the "C's", Then the "Com's"**

First, we look for the "C's" in the page corner, then we find the "Com's".

40. **In Alphabetical Order**

There it is! "Communication" – which means a giving of information by talking, writing, etc. Talking to our friends on the telephone is a form of communication. Speaking of the telephone, does anyone know who invented it?

41. **Let's Look Him Up**

Alexander Graham Bell. Let's look him up in the encyclopedia. What letter should we look under?

42. Last Name First

Last names are listed first, so "B" is right!

43. Find Page With "Bel"

We find the page which has words beginning with "Bel". On it we find . . .

44. Alexander Graham Bell

. . . Alexander Graham Bell, complete with picture! See how easy it is? Looking things up can be fun, too, now that we all know how.

45. Three Valuable Friends

You've learned how to make these three books unlock all their secrets to you. Now they'll be your friends and valuable servants for life.

Filmstrip Narration

"COMMUNICATIONS AND THE COMMUNITY"

Introduction:

Today we're going on an adventure which will take us back to the days of cavemen . . . and way out into space! We're going to explore the wonderful world of communication. That means the sending and receiving of messages. It's a long word, but an important one. Let's try to pronounce it together! *Com-mun-i-ca-tion.* Fine! Why is the word so important? Because communication links us all together, like roads going from one part of the community to another.

1. Roads Are Links

Yes, roads are links – people use the roads to go from one part of the community to another to communicate with people.

2. Wires Are Links

Of course, some wires are links, too. What kind of wire is this? (discussion) Telephone wires link us together, even when we're far apart. Telephone wires help us communicate. If we couldn't get important messages quickly to each other, the community, the whole country wouldn't work very well. But thousands of years ago, there were no countries, communities, wires. Anyone know what the first men lived in? (discussion)

3. Men Lived In Caves

Men lived in caves. At first, Mr. Caveman and his family just grunted, and then they learned how to speak *words* – this was the first big step in learning better ways of communicating. But they had to be within speaking or shouting distance. Suppose a caveman wanted another caveman who lived far away to go hunting with him. How would he get the message to his friend? Anyone want to guess?

4. Runners Carried Messages

Runners carried messages. The only way Mr. Caveman could get a message from one place to another was to run with it. As civilization grew, man's way of life changed, but he still used runners to send messages.

5. Egyptians, Greeks Used Runners

Yes, even the Egyptians and Greeks needed runners in order to communicate. As communities and countries grew, faster communications between them was necessary. Man discovered that . . .

6. Horses Were Faster Than People

. . . horses were faster than people, and didn't tire nearly as quickly. Romans sent messages between communities on horseback.

7. **Pony Express Riders Carried Messages**

Pony Express riders carried messages before there were railroads to carry the mail. But man still wanted to send messages faster than a runner . . . or a horse could travel.

8. **Indians Used Smoke Signals**

We know that Indians used smoke signals to send messages, but only the simplest messages could be sent this way . . . .

9. **When It Rained — No Signals**

. . . and none at all when it rained, because that put out the fire. Sometimes man used . . .

10. **Mirrors Sent Messages**

. . . mirrors to send messages by reflecting light from the sun.

11. **Lights Were Used**

Lights from lanterns were used when it was dark. The trouble with this was they couldn't communicate over long distances – only far enough away to be *seen*.

12. **Samuel Morse and the Telegraph**

And then, in 1844, Samuel Morse invented the telegraph. Anybody know what makes it work? That's right . . . *electricity*. Code messages (called Morse Code) are sent over long distance through electric wires, and come out as clicks on the telegraph. Now man could send messages much farther than he could see, and much faster than even a horse could run. But man still wanted to send his voice over long distance, to carry on a real conversation.

13. **The First Telephone**

In 1875, the first telephone was invented by Alexander Graham Bell. From this invention came . . .

14. **The Modern Telephone Links Us All**

. . . the modern telephone that links us all. It's an important means of communication.

15. **A Chain of People**

People use the telephone for many different reasons. Of course, there are many other ways for sending information to each other. Can you name some of them? (children identify)

16. **Newspapers and Magazines**

Newspapers and magazines give us messages about what is happening in our community and all over the world.

17. **Radio**

And so does the radio. Through it we *hear* the news.

18. **Television**

And, of course, we all watch television for learning and pleasure.

19. **The Mail Is Here!**

The mail is here! How exciting it is when the mailman comes! He brings us *personal* news and messages from relatives and friends.

20. **Many Ways to Communicate**

We've seen many ways to communicate. We use all of them in our daily lives. We wouldn't need to if everyone could stay within speaking distance of each other, as they did in Mr. Caveman's time. But communities have gotten larger and larger, and communications have grown with them.

21. **We All Use the Telephone**

We all use the telephone, and we use it for many different reasons.

22. **Mother Uses It**

Mother uses it . . . wouldn't Mother be lost without the telephone? She uses it . . .

23. **To Call Father**

. . . to call Father when he's at work. Maybe she wants him to bring something home from the store.

24. **Or The Doctor**

Or the doctor when there's sickness in the family . . . or for making an appointment with the dentist.

25. **Or The Plumber**

Or the plumber if there's a leak in the water pipe. A telephone call will get the plumber to fix it.

26. **You Call Mother**

You call Mother so she won't worry when you're going to be late getting home from school.

27. **Can You Play In The Game Today?**

You use the telephone when you're trying to get a team up for a ball game.

28. **Businessmen Use It**

Businessmen use it to get answers to questions and to talk to their customers.

29. **So Do TV Repairmen**

So do TV repairmen. People call them to let them know that their sets need fixing.

30. **And Merchants**

And merchants of all kinds use the telephone to order the goods they will sell to you and your family.

31. **And Drivers**

And drivers of automobiles and trucks use the telephone to get help when they break down on the highway. Can you remember some of the people who use the telephone?
(children review)
One of the most important uses of the telephone is in an . . .

32. **Emergency**

. . . emergency. Many a quick call to the fire department . . .

33. **Telephone Call Saved A Home**

. . . has saved a home that would have burned to the ground. If a fire should start in your home, the most important thing is to get right out of the house. Go to the nearest telephone and . . .

34. **Dial "Zero" for Operator**

. . . dial "zero" for operator. See it on the dial? It's the *last* numeral. The word "operator" is with it. The operator will answer.

35. **She Will Help You**

She will help you by connecting you with the fire department, or in other emergencies . . .

36. **With the Police**

. . . with the police . . .

37. **Or The Doctor**

. . . or the doctor. The telephone is a real friend in need! It takes a lot of people and equipment to keep it working.

38. **Telephone Building**

This is a telephone building. Does anyone know where the telephone building is located in our community? In lots of ways, this building is important in joining the community together. When you dial a telephone number . . .

39. **Automatic Equipment**

. . . automatic equipment inside the telephone building connects you with the person you are calling. Hundreds of calls go through this building each day. But telephone service wouldn't be complete without . . .

40. **Community Helpers**

. . . community helpers like these telephone operators. They handle emergencies, long distance and other special calls. There are also

some other people who help keep the telephone working.

41. Some Install the Telephone

Some install the telephone in your home when you move or when Mother wants it in a new location.

42. Others Keep It Working

Others keep it working so that the telephone can be a dependable friend when needed. How far can telephone messages travel? Guess?

43. Telephone Links Us Together

The telephone links our country with the rest of the Western Hemisphere . . . in fact, it reaches out to almost the entire world!

44. The World Is Linked

Yes, the whole world is linked by the science of communication. Now, satellites orbit the earth. They can carry both telephone and television messages and TV pictures to many parts of the world. And that's not the end!

45. Man Has Entered Space

Man has entered space . . . sending back messages that link him to the world he leaves behind .

46. Messages From the Moon

Just think . . . someday soon you may be able to pick up a telephone and talk to your friend . . . even if he's on the moon!

Filmstrip Narration

"HOW THE TELEPHONE WORKS"

Introduction:

Can everybody hear me? (Wait for answer.) That's because my voice is traveling through the air of the room to your ears. I know that sounds simple; but think about it. You can't touch or see a voice, it doesn't seem to be a real *thing* – yet, it travels from me to each one of you.

1. Voice Can Travel Faster Than Jet

Sometimes your voice travels much faster than the fastest jet. It travels over electric wires, quick as a flash! Of course, it needs the help of electricity to go that fast. Now there's something in our homes that uses electricity, and your parents use it almost every day to send their voices across town. What is it?

2. Old-Time Telephone

The telephone, of course. Here is an old-time telephone. How long do you think people have been using telephones? Guess. Almost a hundred years (since 1876). This old telephone doesn't look much like the telephones of today, does it? . . . If you lived then, you would have had to shout into the telephone to be heard.

3. Today's Modern Telephone

With today's modern telephone, you just use your normal speaking voice – no shouting. The telephone not only *looks* better; it *works* better.

4. How Does It Work?

But *how* does it work? Jimmy here has just finished talking to his friend Tommy, who lives five miles away. Yet the telephone let them talk quietly, as though they were in the same room together. What made their voices travel back and forth like that? To find out let's go all the way back to the 1870's, when the telephone was invented. Can someone tell me who invented the telephone?

5. Alexander Graham Bell

Right! Alexander Graham Bell. Here we see him working on one of his experiments with *sound,* which led to the invention of the telephone. Mr. Bell became such an expert with sound . . .

6. Talking Dog?

. . . they tell a story of how he was able to train a pet dog to make sounds that were almost like words. "How Are You Grandmother?" Mr. Bell knew that all sound travels in *waves.* What do sound waves look like?

7. You Can't See Sound Waves

You can't see sound waves. They're caused by movement of the air, and you can't see *air.* But when something makes the *air* move in waves . . .

8. **Something Like Water Waves**

. . . it's something like the waves that spread out when you drop a pebble into still water. Water waves only spread out on the *surface* of the water. But since sound waves travel through the *air*, and the air is all around . . .

9. **Sound Waves Go In All Directions**

. . . sound waves spread out in all directions. If you could see them, they would look something like this. But what *makes* the sound waves? This drum, for instance; will someone tell me what someone must have done to cause sound waves? That's right – somebody hit it!

10. **Vibrations**

Hitting made the tight skin of the drum shake back and forth. Those shaking movements are called *vibrations*. See the word? Let's try it together! Vi-bra-tions. Here's another kind of vibration you're probably familiar with.

11. **Car Vibrates**

Ever been in a car when it crosses the railroad tracks . . . or travels on a bumpy road? When it hits the tracks or bumps, you can feel it shake, that is, *vibrate*. Not only that! The vibrating car . . .

12. **You Vibrate**

. . . passes along its vibrations to you! You vibrate. You shake the same way, in the same *pattern* of *vibration!* those are important words to remember, because we're going to use them again: *pattern* of *vibration*.

13. **Guitar String Vibrates**

When you pluck a guitar string, the vibrating string disturbs the air around it, and makes it move in the same *pattern* of *vibration* as the string. In other words, it passes the vibration along to the air, in somewhat the same manner that the shaking car passes *its* vibrations along to *you*.

14. **Sound Waves Move Through Air**

The vibration patterns which now move through the air are called sound waves.

15. **High Sound Wave**

A high sound wave is produced when the vibration is fast . . . notice the waves are close together.

16. **Low Sound Wave**

A low sound wave is produced when the vibration is slow – as when a low note is plucked on a guitar. See the waves are now farther apart.

17. **Many Different Sound Waves**

There are many different patterns of sound waves. They all sound different when you hear them. How do we hear them?

18. **Sound Waves Enter Ear**

When sound waves enter your ear, they strike against a certain part of it, deep inside. Anyone know what it's called?

19. **Waves Hit Eardrum**

That's right! It's the eardrum. When sound waves hit this thin sheet of stretched rubbery flesh they . . .

20. **Eardrum Vibrates**

. . . make the eardrum vibrate. The arrows show where it moves back and forth. This vibration passes along the pattern of sound waves . . .

21. **Bones and Nerves Carry Sound**

. . . to little bones and nerves behind your eardrum. These bones and nerves carry the pattern of the sound waves . . .

22. **To Your Brain**

. . . all the way to your brain. And that's how we hear all kinds of sounds, from guitars being strummed to people talking.

23. **We Make Sound Waves**

We make sound waves, too! Every time we say something out loud. Anybody know how we talk? Well, yes, with our mouths, but that's only part of it.

24. **Vocal Cords Here**

We each have two vocal cords – little flaps of flesh – here in our throats. What's the bump on the man's throat called? That's right . . . Adam's Apple! (youngsters may have trouble locating because of their age.)

25. **Everybody Say A-H-H**

Now everybody touch his vocal cords and say a-h-h. That's enough. Feel the vibrations produced by your vocal cords?

26. **We Force Air Between Vocal Cords**

That's because we're forcing air between the vocal cords, up from our lungs. This causes the vocal cords to vibrate and create sounds.

27. **Like A Party Noisemaker**

The cords vibrate very much like a party noisemaker.

28. **We Form Words**

We form words by shaping the sound with our lips and tongue. Sound waves carry our voice and words out of our mouths . . .

29. **Sound Goes To Listener's Ear**

. . . to a listener's ear. That's how we speak to each other. But we have to be close by . . .

30. **Sound Waves Can't Travel Far**

Sound waves can't travel far over long distances without help. The farther they go, the harder they are to hear. Finally, they become so weak you can't hear them at all!

31. **Telephone Sends Voice Around World**

But the telephone can send the human voice around the world . . . *instantly* with the help of electricity . . .

32. **In The Telephone Building**

. . . and with the help of people and equipment in the telephone building. Everything is done to make sure your voice goes through the telephone loud and clear. Let's take a trip through the telephone.

33. **Voice Sound Waves Enter Transmitter**

When we speak into the telephone, the sound waves of our voices enter the transmitter. How many parts do you think the transmitter has?

34. **Twenty-Seven Parts**

Twenty-seven parts. But we'll only talk about the main ones that help pass the voice along. The first of these is that thin metal plate – see the arrow? That plate is called a diaphragm.

35. **Sound Waves Make Diaphragm Vibrate**

Sound waves entering the transmitter make the diaphragm vibrate. Remember how we saw the drumhead vibrate when it was struck? Well, the diaphragm also vibrates back and forth when sound waves strike it.

36. **Carbon Granules**

Just behind the diaphragm are tiny grains of carbon that look like ground up coal, or black sand. They are called *carbon granules.*

37. **Diaphragm Is Pushed And Pulled**

As you speak, the diaphragm is pushed and pulled by the sound waves – back and forth – back and forth – making it vibrate in the same pattern as the sound waves your voice makes.

38. **Vibration Controls Electricity**

The vibration caused by your voice determines the amount of electricity that passes through the carbon granules.

39. **More Electricity**

Some sound waves make the diaphragm press harder against the carbon grains, and this lets *more* electricity pass through them, and out to the telephone wire.

40. **Less Electricity**

And other sound waves don't press hard, *so less electricity* gets through to the wires.

41. **Changing Flow, Changing Pattern**

It is this changing pressure – sometimes more – sometimes less – that carries the changing pattern of your voice through the grains and through the wire to the other telephone.

42. **Flowing Along The Telephone Wire**

You see? The vibrations that make up your voice pattern have been changed to electrical waves that go through the telephone wire.

43. **Through The Telephone Building**

The pattern of your voice is then carried by electricity to the telephone building, where machines make it stronger and direct it . . .

44. **To The Other End Of The Line**

. . . to the other end of the line, to the telephone receiver of the person to whom you are speaking. How quickly does it get there? Well, electricity travels so fast that it can go around the world seven times in *one second!* This means that the electricity carrying your voice pattern goes to the receiver of the person you are speaking to . . .

45. **Instantly!**

. . . instantly! That's right – in much less than a second, no matter *where* you are! However, before your friend can hear your voice, the electricity carrying your voice must be changed back to sound vibrations. This is done inside the receiver you hold snug against your ear.

46. **Another Diaphragm**

Here we find another diaphragm like the one we saw in the transmitter.

47. **Electromagnet**

Right behind the diaphragm is an important piece of equipment . . . it is called an electromagnet.

48. **Electricity Makes It Work**

Electricity makes it work. It becomes a magnet only when electricity flows through wires wrapped around the center piece. So when the flow of electricity is *strong,* the *pull* of the magnet is strong. When the flow of electricity is *weak, the* pull of the magnet is weak.

49. **Magnet Makes Diaphragm Vibrate**

It is this strong-weak, strong-weak pull of the magnet that makes the diaphragm vibrate.

50. **Vibrations Make Sound Waves**

It is these vibrations that make sound waves come out of the receiver. They repeat the pattern of the same sound waves that your voice sent into the transmitter at the other end! And so your voice and words come out of the receiver just as you speak them.

51. **Telephone: Community Helper**

Yes, the telephone is a community helper. It makes it possible for us to talk to each other, even when we're miles apart. It brings the whole community together.

52. **People Depend On It**

People depend on it. Businessmen, doctors, shopkeepers, your parents – they all depend on the telephone to get things done.

53. **Telephone Calls By Satellite**

And now it's possible for telephone calls to be relayed to different parts of the world by satellites way up in the sky.

54. **We've Come A Long Way**

We've come a long way from the beginning, haven't we? Someday, you might follow in the footsteps of Alexander Graham Bell.

TEACHER'S NOTES

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