

Telephone Design for People with Special Needs



Making the Connection
Women in Engineering Programs &
Advocates Network (WEPAN) Project
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Communication

Grades 3 & 4 (suggested)

1. The unit explores concepts and telephone designs that would be useful for people with special needs such as visual or hearing impairment, or lack of fine motor skills.
2. The activity encourages students to approach the problem as engineers.
3. The activity has a resource page that provides background information.

Objective

The goal is for students to understand the basics of engineering associated with the design of telephones to make them more accessible and useable for people with special needs. Phones are everywhere in our lives. We have them in our homes, schools, at work, and in public access areas. The use of cellular phones has put them in places we never had them before such as cars. Phones provide an easy way for most of us to communicate with other people. The design of telephones by engineers has focused primarily on making them useful for the average person, and on the aesthetics of the phone. This unit focuses on the engineering re-design of phones to improve their usefulness for people with special needs.

Skills & Standards

1. Analyze a product's components and their functions.
2. Recognize a design need or engineering problem.
3. Communicate the solution through drawing and speaking.

Activity Outline

Materials required per group: Part 1

- Real telephone (2 or 3 per class or 1 per group)
- Paper
- Markers, crayons and/or colored pencils

Materials required per group: Part 2

- Assorted materials to make a model of a phone such as:
- Shoebox, small shirt box, jewelry box or other small containers
 - Construction paper
 - Markers, crayons
 - Empty film canisters
 - Paper towel or toilet paper tubes
 - Glue and tape
 - Buttons
 - Twine/yarn

Timeframe:

- Part 1: 45 minutes
- Part 2: 45 minutes

Overview of Presentation

Briefly explain engineering (See Presenter's Guide for more detail.)

Engineers use scientific information to design and create useful things. In designing and creating, the engineer goes through a problem solving process in which both math and science are important components.

Introduce the activity to the students.

Have a general discussion about telephones. Encourage students to share what they know about telephones and what types of things are important on a telephone.

Begin the activity.

Before doing the activity, present the *'problem'* and *'who wants to know'*.

Do the activity.

Divide the class into groups if you have more than one adult leader. Each group of students should have an adult leader. As the students work on the activity present *'how can you help solve the problem'* to help them with the brainstorming and testing.

Reflect on the activity.

After the activity is completed, spend time discussing what was discovered and learned. How are the phones for people with special needs different? How are they the same? Present *'will your suggestion work'* to think about potential re-tests.

Career Connection

Discuss what types of jobs are involved with understanding telephone design and how to produce effective telephones. Asking *'Who can help you solve the problem'* may get students to think about the type of people who would know.

Activity: Re-thinking telephones

This activity has the students participate in a variety of simple activities to better understand the issues people with special needs may have. With these experiences in mind, the students will redesign phones so that they are more useful for people with special needs. The activity has been developed based on a traditional engineering design process which pose key questions – all identified in boldface type, that help the students approach the problem as engineers.

PART 1A: EXPLORING LIMITS IN ACCESS

What's the problem? Many people have hearing, visual impairments, or limited motor skills. These people also need to be able to use telephones to communicate. Often the standard phone is difficult for them to use.

NOTE: *Each group should do the following process for each of the three special needs separately. It is important to have at least one sample phone and one adult leader for each group of students. Be aware of the sensitive nature of special needs and discuss them with a positive outlook.*

- **Vision impairment:** Use the example phone. Have the students close their eyes, try to pick up the receiver and call the emergency number 911.
- **Hearing impairment:** Have the students pretend that they have a hard time hearing. Have them discuss the types of things they need to hear when using a phone such as dial tone, voices, and ringing.
- **Lack of fine motor skills:** Use the example phone. Have the students limit their fine skill hand motion by either putting socks or mittens over their hands or by wrapping their fingers together with masking tape. Then have them try to pick up the receiver and call the emergency number 911.

PART 1B: CREATE YOUR OWN TELEPHONE DESIGN

Who wants to know? Telephone companies want to develop telephones that everyone can use.

How can you help solve the problem? Think about the special needs you just experienced. How do your phone needs vary from people without these special needs? What suggestions do you have for how phones could be changed to meet their needs? Use *Worksheet 1: Design Considerations* as a reference to facilitate the discussion.

1. Divide the students into groups of 2 or 3. Assign each group with a specific special need (hearing or vision impairment or lack of fine motor skills) to focus on for their phone redesign. Make sure to assign each type of special need so that there will be a variety of solutions.
2. Have each team draw a picture of their proposed design. You may want to have the students use *Worksheet 2* as a reference page for their drawing. Encourage creative solutions in their drawings.
3. After the drawings are done, lead a discussion in which each group presents their idea(s) for the phone.

PART 2: BUILD A MODEL TELEPHONE

1. Distribute the construction materials and have each group of students build a model of their proposed phone.

Will your suggestion(s) work? Have each group present their drawing or model to the class. During the presentation encourage them to show their special feature(s) and describe how this will help the people with the type of special need that was assigned to their group. See *Worksheet 2* for some of the considerations.

Who can help you solve the problem? What type of information or knowledge is needed to understand special needs and telephone design? Human factor engineers are concerned with designing items so that they can be comfortably used. Materials engineers work with the plastics that are used in phone construction.

Engineering Summary: Finish with a discussion about how the students acted as engineers.

Activity Resource Page

Background Information for Activity Leader

The design of the telephone incorporates several engineering fields including electrical, materials, design, and human factors engineering. The final design utilizes materials that provide durability and strength while incorporating the electrical engineering components of transmitting and receiving the signals. Good designs also have human factors engineering which contribute to make the telephone 'fit' the user and feel more comfortable. Another important component in the design is the consideration of special needs that the telephone user may have.

The telephone was patented in 1876 by Alexander Graham Bell. The first phones used a dialing mechanism to enter phone numbers one at a time. Since the 1960's most telephones manufactured use a key pad to enter the phone numbers. Telephones are connected to each other by a vast network of wires. The communication from phone to phone occurs by converting the sound waves of your voice to electrical current. This current is sent through the wires and converted back to sound at the receiving end. Wireless, or cellular telephones, use radio waves to transmit signals instead of sending current over wires. The telephone is made up of three primary parts, 1) a dialing mechanism, 2) a transmitter, and 3) a receiver. The size and shape of the telephone has changed over the years. The changes have mostly been based upon changes in technology that allow for smaller telephones and clearer transmission of voices.

TIPS

Involve local experts to enhance the activity. Contact an engineering school at a local university, WEPAN at www.wepan.org or the Society of Women Engineers at www.swe.org.

Potential Safety Issues

None

Vocabulary Words

Handset – part of the phone picked up to make the phone call

Earpiece – part of the phone used for listening

Mouthpiece – part of the phone used to speak into

Dial Tone – sound the phone makes to indicate that there is an open connection ready to receive the call

Questions to Ask

As you go through this activity with the students you should lead them through the process by asking the questions provided in the design approach of the activity.

Additional questions to ask:

Q: Does the handset have to be lifted to activate a phone call?

A: On conventional phones, yes – but telephones could be designed with a different type of switch that would activate the call.

Q: How do you know when you are pushing the numeric keys to place a call?

A: The phone sends a 'touch tone' for each key press to the earpiece letting you know the key has been pressed.

Q: What could be done to let you know you pushed a key if you were hard of hearing?

A: You could have an indicator that was not sound based, such as a light that flashed for each key press.

Expanding the Activity

1) Video screens can be part of the phone system. What would be the important features of the video screen for the special need you are addressing?

2) Do a family research project. Get at least one relative to describe the types of telephones they have used during their life. Have them sketch pictures or show you photos of what they looked like. Ask them what they liked or disliked about the different phones.

Additional References

www.howstuffworks.com/telephone.htm

Worksheet 1

Design Considerations

Reference sheet for leader

Special Need: Visual Impairment

Issue	Potential Solutions
Locating the phone	Bright colors Locating noise
Identifying numeric keys	Shape differences Markings on keys Coloration

Special Need: Hearing Impairment

Issue	Potential Solutions
Hearing the dial tone	Light indicator
Knowing that good contact has been made with keys	Light indicator Motion of keys
Hearing the phone ring	Light indicator Motion of phone
Hearing the conversation	Volume control Conversion of audio to text

Special Need: Lack of fine motor skills in hands

Issue	Potential Solutions
Picking up the receiver	New shape Speaker phone
Pressing the correct keys	Size of keys Shape of keys Voice control of dialing

Worksheet 2

Pictures of Telephones



Draw your new phone design in this space.