

Introduction

This topic uses the context of long distance communications to get pupils thinking about how scientific ideas are used to develop solutions to challenges and how technology is about comparing and evaluating different solutions. It starts with looking at different ways of sending a message and comparing how well they work. It then goes on to look at one particular technology and challenges pupils to find a route for a submarine cable, avoiding factors that might damage the link.

Finally pupils have to compare two different systems and decide which one is better, bearing in mind a number of factors. In so doing they have to decide what makes a communications system better suited to a purpose.

Overall learning objectives

- To explore different communications systems
- To compare systems, identifying strengths

Overall learning outcomes

- To be able to explain different communication systems and how they work
- To be able to compare different communication systems

Curriculum learning objectives:

Science:

Pupils should be taught to:

- compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- use recognized symbols when representing a simple circuit in a diagram

Technology:

Pupils should be taught to:

- understand how key events and individuals in design and technology have helped shape the world
- understand and use electrical systems in their products (for example, series circuits incorporating switches, bulbs, buzzers and motors)

Geography:

Pupils should be taught to:

- describe and understand key aspects of human geography, including economic activity including trade links

Episode 1

Ways of communicating – sound, light, telephone, semaphore

Resources required:

- Torch (for the beam of light). *It needs to be bright enough to be easily seen without running the risk of dazzling people.*
- Sticks or flags (colours unimportant) can be improvised.
- The circuit is a simple series circuit with battery, switch and either a bulb or a buzzer. The wires need to be long enough to reach across the room and care will be needed to avoid this becoming a tripping hazard.

Learning objectives

- To understand how information can be communicated in various ways and consider the advantages and shortcomings of each

Learning activities

1. Start off by asking pupils the various ways in which information could be sent from one side of the classroom to another, without physically crossing it.

Take feedback and display ideas on the board. They might include:

- Light
- Sound
- Using a telephone (conventional, with wires)
- Showing a sign of some sort
- Using radio or mobile phone

2. Explain that you're going to focus on three of these. Say that you're going to explore how it would be possible to use *light*, *signs* and *circuits*. Explain that at the time (Victorian times) radio had yet to be invented and the distances we want to use are too great for sound to be practical.

Ask pupils to work in pairs and give each pair the job of inventing a way of sending information by:

- Using a beam of light
- Using some form of signs, such as sticks or flags
- Using an electrical circuit which reaches from one place to the other

Give pupils a few minutes to devise solutions. Then gather pupils working on a particular approach together and ask them to share their ideas. Repeat with the other two groups.

The activity sheets develop each of their ideas in more detail.

Use Activity sheets 1, 2 & 3 to develop the ideas further and guide pupils to carry out an investigation which involves using code.

Pupils need to work in groups; each group is then divided into two and one half of the group has to communicate a word to the other half using a particular code and technology.

The key point is that pupils evaluate the particular technology and identify its strengths and weaknesses, which can then be shared. Depending on time available pupils may all be able to have a go at each technology.



Outcomes

- To explain how different technologies can be used for communication and what advantages each has.

Episode 2:

Planning a link – choosing a route

Resources required:

- Copies of the Activity sheet 4 (Map) printed A3 size, enough for pupils to work in pairs

Learning objectives

- Explore the challenges of using submarine technology for communications
- Consider how engineers can avoid potential problems in the routing of cables.

Learning activities

1. Explain that one of the uses of cable communication was being able to connect countries separated by water. Cables could be run under the water and messages sent using circuits that linked countries. Explain that this meant laying cables though, and this could be a tricky business. Once a cable is broken, the circuit ceases to work. No circuit means no communication.

2. Show pupils a picture of a submarine cable and ask them to suggest the risks to the safety of the cable by various features, such as:

- Sharp rocks (could chafe and damage cable)
- Drilling area (drill could damage cable)
- Mooring area (anchors could damage cable)
- Fishing area (trawl nets could catch on cable)
- Soft sand (might leave cable exposed to weather and thieves)

Then hand out copies of *Activity sheet 4*, which presents pupils with a map of an area of sea between two pieces of land. The idea is that they draw the route of a communications cable to link towns A and B, using the shortest route whilst avoiding potential hazards. This will work best if the sheets are printed A3 size and pupils work in pairs. They should plan a route and be prepared to share the reasons for their decisions.

After pairs have been able to develop their responses, ask some to share their ideas. A good way of doing this is by using a visualiser, so that they can explain the route that they adopted.



Outcomes

- To plan and justify a route for a submarine cable, showing how hazards were avoided whilst minimising the amount of cable used.

Episode 3: Technologies in competition

Resources required:

- ☐ Activity sheet 3 to support pupils to test the Morse circuit
- ☐ The circuit is a simple series circuit with battery, switch and either a bulb or a buzzer. The wires need to be long enough to reach across the room and care will be needed to avoid this becoming a tripping hazard.
- ☐ Activity sheet 5 printed on thin card
- ☐ Scissors
- ☐ Paper fasteners

Learning objectives

- To understand how technological solutions may have to compete for interest and support.
- To evaluate the comparative merits of Morse and Siemens transmitter and receiver systems.

Learning activities

Pupils may imagine that when new discoveries or inventions emerge that they are openly and widely accepted. In fact, it is often the case that ideas have to compete for interest. This episode is about comparing two technologies, each using circuits.

1. Explain to pupils that in the 1840s there were two competing systems that could be used by people wanting to set up communications links.

One was a Morse code system which used dots and dashes. An operator would send messages by turning them into code and then tapping the message out. The receiver listened to the short and long sounds and converted these back into letters. The other was the Siemens pointer system, which used a dial. The operator would press one of 30 switches, which made the pointer swing round to point to a letter. Releasing the key brought the pointer back to the start.

Explain that they are going to compare these two systems. The Morse code can be set up using [Activity sheet 3](#) to build a simple circuit with either a buzzer or a bulb. Pupils should work in small groups and arrange to send a message by turning it into Morse code, transmitting using light or sound and decoding at the other end. The Siemens system can be represented using a pointer and dial, set up using [Activity sheet 5](#). Explain that the real system would work electrically but that this is a mock up to allow the systems to be compared.

[Activity sheet 3](#) can be used to support pupils to test the Morse circuit and [Activity sheet 5](#) to set up a model of a Siemens pointer telegraph (note that this sheet needs printing on thin card and the use of scissors and a paper fastener – it is a good idea to try this out beforehand).

2. After they have tried using both systems ask them to compare them.

They could explore questions such as:

- How easy is each system to use?
- Would either system get quicker with practice?
- How quickly can messages be sent?
- Which do they think is the better one, and why?

Make the point that engineers sometimes develop different solutions to a problem. These solutions can then be compared in a number of ways to identify the best one.

Outcomes

- To have explored Morse and pointer communications systems
- To have compared and evaluated the two systems