

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Lesson 1			
Slide	Subject	Description	Timing
1	Introduction	Introduce the basic concept of satellite communication	10 min
2	Q & A	Discuss with the class how Satellites affect the everyday life and why it is important to communicate with them	5 min
3	Q & A	Conduct with the class the Q & A of the basic lecture	10 min
4	Signal to Noise Experiment	Conduct with the class the signal to noise experiment	20 min

Lesson 2			
Slide	Subject	Description	Timing
1	Conclusion of Lesson 1	Discuss with the class how classroom communication and satellite communication are similar	10 min
2	Signal vs. Information	Discuss with the class how a pure signal is different from a signal with information	5 min
3	Communication Experiment	Conduct with the class the communication experiment	20 min
4	Summary	Discuss with the class how information are included into speech, in written form, into radio waves. Point out the satellites use binary data.	10 min

Power point Example

NEUROHEADWAY

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SATELLITE COMMUNICATION

BASIC



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THIS LECTURE CONTENT

- Introduction
 - ▶ Why do satellites need to communicate with earth?
 - ▶ Examples
- Communication basics
 - ▶ Classroom communication
 - ▶ Signal to Noise
- Signal to Noise Experiment
- Communication experiment
- Summary

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SATELLITE COMMUNICATION

BASIC

INTRODUCTION

Why do satellites need to communicate with earth

- Satellites are our messengers and servants that we send to space to perform certain tasks that we ask them to do?

Q1:

- do you know some tasks that we use satellites for?

A1:

- To learn about earth
 - For earth science, to check how earth is doing.
 - To help disaster mitigation
- To explore our solar system and the universe
 - Telescopes like Hubble watch the stars
 - Satellites around other planets deliver pictures and data of those.
- To ease our everyday live
 - Broadcast TV (you see satellite dishes all around)
 - Weather prediction
 - Satellite based navigation system

MerOp (ESA)

GOES-16 (NOAA)

Hubble Space Telescope (NASA)

Mars Reconnaissance Orbiter (ESA)

Galileo (ESA)

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SATELLITE COMMUNICATION

BASIC

- Introduction
- Communication Basics
 - Introduction
 - Communication Basics
 - Signal to Noise Experiment
- Signal to Noise Experiment
- Communication Experiment
- Summary

SIGNAL TO NOISE EXPERIMENT

- Now let's experience the impact of the different parameters on the communication or rather signal quality
- Equipment:
 - Have two large pieces of paper to later form:
 - A speech tube
 - A listening tube
- Conduction:
 - Locate:
 - a group of students on two most distant corners of the classroom
 - better go outside to have the necessary space
 - Select:
 - a "transmitter" – the person who speaks/shouts
 - a "receiver" – the person who listens
 - The "noise" – a group of students standing around the "receiver" who will be creating the noise.



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SATELLITE COMMUNICATION

BASIC

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SIGNAL TO NOISE EXPERIMENT

- Conduction:
 - Step-by-step procedure:
 - Ask the "transmitter" to say something to the "receiver", and tell the receiver to write it down or repeat it.
 - Over a short distance
 - This is a normal, understandable communication
 - Let the signal get worse
 - Communication over a large distance
 - Increase the distance between the groups
 - This increases the "space loss"
 - Voice "spreads" over a bigger area, and is therefore weaker
 - Goal is that the "receiver" barely understands the transmitter.
 - Communication in the presence of noise
 - Let the students around the "receiver" talk and whisper to the "receiver"
 - This creates a noisy background against which the signal / transmission must be recognized.
 - This shows the impact of "noise"
 - Let the students adjust the noise level such, that the speech from the "transmitter" is not understood any more.

$$\frac{S}{N} = \frac{P_t \cdot G_t \cdot G_r}{L_s \cdot N}$$
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