5E Lesson Plan

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| **Teacher:**  |
| **Date:** |
| **Subject / grade level:** Science, Grade 8, Lesson #6 |
| **Topic:** Waves |
| **Materials:**Computer, COSMOS Technology Toolkit, Science Textbook   |
| **Essential Question(s):** How has technology changed the way we communicate?   |
| **Standards (NGSS):** MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

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| **Science & Engineering Practices (SEPs)** | **Disciplinary Core Ideas (DCIs)** | **Crosscutting Concepts (CCs)** |
| **Developing and Using Models**Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. **Obtaining, Evaluating, and Communicating Information**Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods. | **PS4.A: Wave Properties**A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)**PS4.C: Information Technologies and Instrumentation**Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3) | **Patterns**Graphs and charts can be used toidentify patterns in data (MS-PS4-1) **Influence of Science, Engineering, and Technology on Society and the Natural World**Technologies extend the measurement, exploration, modeling, and computationalcapacity of scientific investigations (MS-PS4-3) **Science is a Human Endeavor**Advances in technology influence the progress of science and science has influenced advances in technology (MS-PS4-3)  |

**Common Core State Standards (CCSS):****SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.  |
| **Lesson Topic:** Bandwidth and Data Rate **Learning Target:** I will: * Understand what signal bandwidth is.
* Understand how bandwidth affects the rate with which we transmit information.
* Perform an activity using the wireless testbeds that will demonstrate how bandwidth affects data rate.
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| **Differentiation strategies to meet diverse learner needs:*** **Bodily kinesthetic learners** - Local and Express demonstration hands-on activity
* **Audio and Visual learners** – Slide show, Visual representation of activity using computer, transmitter and receiver, The observations/data collected throughout the activity
* **ELL/Low reader** - Guided notes printed for those who require them
* **Technology**- Utilizing COSMOS Technology Tool Kit
* **Extended time** for those who require it
* **Small groups** according to levels, behavioral needs, and activity requirements
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| **ENGAGEMENT** 1. Discussion Question(s)
* What is bandwidth?
* Why is bandwidth important in transmitting information?
1. Teacher will use a short slide-show to explain bandwidth and data rate
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| **EXPLORATION** 1. Materials & equipment are set up on student’s desks. Students are in small groups & will assign roles to each other for the activity, e.g. note taker, reader etc. One student will read out loud from the handout and the group will perform the activity.
2. Activity:
3. Teacher will log students into the Testbed (ORBIT/WITEST/COSMOS), open 3 terminals and turn on the nodes.
4. Students will follow the directions and create a transmitter terminal and a receiver terminal.
5. On the receiver node students will run a command to start a visualization server and wait for confirmation that it is running successfully. In Google Chrome students will open an **Incognito** browser window. Then open the URL that is shown in the Shiny server output. (<http://localhost:8100/ShinySDR/> in this example).
6. Students will follow the instructions on their handout to configure the display on the new browser window.
7. Students will now follow the directions on their handout to send a fixed amount of data at a specific rate and measure the amount of bandwidth the transmission occupies.
8. Students will then send the same amount of data but at a faster rate than the previous one and measure the bandwidth it occupies.
9. Students will then compare the bandwidth and the time it took to transmit the fixed amount of data.
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| **EXPLANATION**After students complete their experiment there will be a discussion/share out with their observations and comments about their activities - facilitated by the teacher. Analyzing information collected on their handout and identifying any errors that may have been made and correct them. Explanation of bandwidth, data rate, testbed use, and vocabulary words: ORBIT, WITEST, COSMOS, are all clarified and strengthened.  |
| **ELABORATION**Students will extend their knowledge bandwidth and data rate by discussing the following question(s): Technology is creating larger bandwidth and faster data transfer rates. What problems do you foresee that will affect the faster data rates and larger bandwidths in the future? Will our transactions be safe?   |
| **EVALUATION** 1. Teacher Observation
2. Correctly following procedures
3. Students complete the questions on their handouts
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| **HOMEWORK** Research and write a short paragraph to explain what transmission data rate is.  |