Unit 9: Comparing the Structure and Function of Digital and Analog Signals

Standard(s):

8.2.6 Obtain and evaluate information to communicate the claim that the structure of digital signals are a more reliable way to store or transmit information than analog signals. Emphasize the basic understanding that waves can be used for communication purposes. Examples could include using vinyl record vs. digital song files, film cameras vs. digital cameras, or alcohol thermometers vs. digital thermometers. (PS4.C)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Information Students obtain, evaluate and derive meaning from scientific information or presented evidence using appropriate scientific language. They communicate their findings clearly and persuasively in a variety of ways including written text, graphs, diagrams, charts, tables, or orally.	**PS4.C Information Technologies and Instrumentation**	**Structure and Function** Students relate the shape and structure of an object or living thing to its properties and functions.

Big Ideas:

Understanding of waves and their interactions with matter has been used to design technologies and instruments that greatly extend the range of phenomena that can be investigated by science (e.g., telescopes, microscopes) and have many useful applications in the modern world.
Light waves, radio waves, microwaves, and infrared waves are applied to communications systems, many of which use digitized signals (i.e., sent as wave pulses) as a more reliable way to convey information.
When in digitized form, information can be recorded, stored for future recovery, and transmitted over long distances without significant degradation.

Preceding Grade Bands:	Target Grade Bands:	Following Grade Bands:
● People also use a variety of devices to communicate (send and receive information) over long distances. ● High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.	● Appropriately designed technologies (e.g., radio, television, cell phones, wired and wireless computer networks) make it possible to detect and interpret many types of signals that cannot be sensed directly. ● Many modern communication devices use digitized signals (sent as wave pulses) as a more reliable way to encode and transmit information.	● Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them.

		• Knowledge of quantum physics enabled the development of semiconductors, computer chips, and lasers, all of which are now essential components of modern imaging, communications, and information technologies

Proficiency Scale:

4 Advanced	3 Proficient	2 Approaching Proficiency	1 Beginning Proficiency
I Can: **Obtain, evaluate and communicate information** about how the structure of digital signals makes them a more reliable way to store and transmit information than analog signals. AND Make a claim to determine the advantages and disadvantages of using analog and digital signals, provide evidence and reasoning to support your claim.	**I Can:** **Obtain, evaluate and communicate information** about how the structure of digital signals used for communication purposes makes them a more reliable way to store and transmit information than analog signals.	**I Can:** **Obtain and communicate information** about how the structure of digital signals makes them a more reliable way to store and/or transmit information than analog signals.	**I Can:** **Communicate information** about the differences between analog and digital signals.

Anchoring Phenomenon:
Play a vinyl record and ask: How is the music stored and transmitted? Play a CD/phone and ask: How is the music stored and transmitted?
Link to Record Players on Amazon:
https://www.amazon.com/Victrola-Nostalgic-Bluetooth-Turntable-Entertainment/dp/B00NQL8Z16/ref=sr_1_8?crid=2CWRQB39MN3DW&keywords=vinyl+record+players&qid=1646158088&sprefix=vinyl+record+players%2Caps%2C209&sr=8-8

Essential Question:

What are the differences between analog and digital signals?

Learning Goals:

- 9A: Obtain and evaluate information to communicate the claim that the structure of digital signals are a more reliable way to store or transmit information than analog signals.

	Learning Opportunities		Formative Assessments
Learning Goal 9A: Obtain and evaluate information to communicate the claim that the structure of digital signals are a more reliable way to store or transmit information than analog signals.			
Engage	• **Phenomenon: Play a vinyl record and ask: How is the music stored and transmitted? Play a CD/phone and ask: How is the music stored and transmitted?** ○ **Vinyl Record Player on Amazon** ***(or play a video of vinyl record playing)***		**Pre-Test: Sorting Signals** **Pre-Test: Sorting Signals-Spanish**
	Teacher:	**Student:**	
Explore	• **Slideshow Discussion -** Take concepts students are familiar with and compare it to analog and digital ○ **Video Example** of teacher leading discussion.		

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<tr><td></td><td>Teacher:</td><td>Student:</td><td></td></tr>
<tr><td rowspan="3">Explain</td><td colspan="2">

<u>Read, Define, and Compare</u> - read an article and define analog and digital signals. Look at pictures to identify the differences in structure of analog and digital signals.
<u>Read, Define, and Compare-Spanish</u>

<u>Copies of Copies</u> (discussion or assignment)
<u>Copies of Copies-Spanish</u>

<u>Research: Analog and Digital</u> - research organizer with links to reliable resources to learn the differences and pros & cons of analog and digital.
<u>Research: Analog and Digital-Spanish</u>

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<tr><td>Teacher:</td><td>Student:</td></tr>
<tr><td rowspan="3">Elaborate</td><td colspan="2">

<u>Technology Research: Analog and Digital</u> - Research a specific analog and digital version of a technology, compare and contrast.
<u>Technology Research: Analog and Digital-Spanish</u>

<u>Storage of Analog & Digital: TV & Music</u>

Book cases of Knowledge

<u>Storage of Analog & Digital: TV & Music - Spanish</u>

Discussion - show analog and digital technologies and discuss the pros and cons - revisit the phenomenon and explain how a vinyl record vs a CD works.

Animation and Film Slideshow and Discussion

<u>Slideshow</u>
Video of teacher leading the discussion: <u>Video Part 1</u>, <u>Video Part 2</u>

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<tr><td>Teacher:</td><td>Student:</td></tr>
<tr><td>Evaluate</td><td colspan="2"><u>Multiple Choice Quiz</u>
<u>Multiple Choice Quiz-Spanish</u></td><td><u>Multiple Choice Quiz</u>

<u>CER Paragraph</u></td></tr>
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	CER Paragraph -Written Portion **CER Paragraph-Spanish**		
	Teacher: We usually give both the written portion and the multiple choice quiz.	**Student:**	