

**COSMOS Experiment- Effect of Noise in the Communication System**

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| **Grade 6-9** |  |
| **Topic:** Find out how the relationship between the Transmit Amplitude and the Noise Amplitude and its effect on the Constellation Diagram.Determine when do we transmit enough power in order to be heard over the noise? | **Materials:*** COSMOS toolkit
* Post-it Chart Paper
* Markers
* Pencils
* Graph Paper
* Noise sensor
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| **Science & Engineering Practices (SEPs)**Evidence Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4) | **Disciplinary Core Ideas (DCIs)**The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS-PS3-3) | **Crosscutting Concepts (CCs)**Influence of Science, Engineering, and Technology on Society and the Natural World. The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-PS2-1)  |  |
| **Math Common Core Standards:****6th Grade:** **6.RP.A.1-**Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.**6.RP.A.3-**Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.**6.EE.9-**Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.**7th Grade: 7.RP.2.a, b, c, d -**Recognize and represent proportional relationships between quantities.**7.EE.B.4-**Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.**8th Grade:** **8.EE.B.5**-Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. **8.EE.B.6**-Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at *b*.**8.F.B.2**Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **8.F.B.4**Construct a function to model a linear relationship between two quantities. **8.F.B.5**Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). **Algebra 1****HSA.CED.A.2**Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.**HSA.REI.D.10**Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).**S-ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. ★ **S-ID.8** Compute (using technology) and interpret the correlation coefficient of a linear fit.★ **S-ID.9** Distinguish between correlation and causation. |
| **Essential Question:** How is the Constellation Diagram affected by the Transmitter Amplitude and the Noise Level in a Communication System? |
| **Learning Target** | Today I am doing an experiment on how the constellation diagram changes its characteristics based on:1. Transmitter Amplitude
2. Noise Amplitude
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| **Engage** | 1. Students will discuss about the different types of noise in the environment and where all these different kinds of noise came from.
2. Students engage in a see, think, wonder of the signal screenshot.
	1. See: What do you notice?
	2. Think: What do you think your noticing mean?
	3. Wonder: Create a question that you would like to explore further based on your noticings and conjectures?
3. Discuss with the students their conjectures and wonderings.
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| **Explore** | 1. Explain experiment procedure
	1. Day 1

- Brainstorm among themselves for about 10-15 minutes about the different types of noise that they encounter in real-life/daily activities around them.-They will classify these noise into different types based on the source.- They will research as a group and find out from different internet sources if their classifications match with theirs or if they discovered something new that they do not know before.-To wrap up the session, they will share the discussion they had and what they find out in their research about the different types of noise and sources that they have came from. Each team will be given 2-3 minutes each.* 1. Day 2

-The students will perform the actual experiment on the “Use GNU Radio to observe the effect of noise in a communication system” and find out how we can transmit enough power to be heard over the noise. |
| **Explain** | 1. In small groups, the students will discuss their observations, their findings, questions, multiple representations of the results and trends based on the data.
2. In a gallery walk, students will present all of their data and make connections across the different groups. They can use this space to discuss results and trends across the groups. \*Peer evaluations\*
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| **Extend**  | * Discuss the relevance of this project to Science and Health, Technology and Mathematics.
* Make a similar experiment at home and find out the different sources of noise and find out how you can eliminate or reduce it/them.
* Discover and make a research on the ill effects of noise in the environment, to health and to the communication system.
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| **Evaluate** | Find out if the students were able to accomplish the main goal/learning target/essential questions posted before the experiment started. Post the projects on the walls and the class will discuss the finding and the results of their experiments after the gallery walk they did on this activity on day 2-3.Feedbacks/questions will be entertained regarding the whole experiment and what they found out. |
| **Differentiation** | Students will be grouped heterogeneously. Each group will be expected to meet the same standards. Graphic organizers and vocabulary sheets will be available to students to use.  |