

NGSS Digital Interactive Notebook

Design Guide



1

Design with an **INPUT/OUTPUT** structure in mind

Information for students to read/view or review

Provide opportunities for students to demonstrate understanding

Scientific Practice #3

Planning and Carrying Out Investigations

Scientists conduct investigations to answer questions. In the process, they identify variables, measure the response in independent variables, collect data and report results.

Directions: When we conduct investigations, we need to identify (and control) the variables. Watch the video on the types of variables, then READ the information about variables.

Watch this

Read this

Independent Variable - What you decide to CHANGE in an experiment.

Dependent Variable - What you OBSERVE or MEASURE in an experiment.

Controls - Possible variables that you make the SAME. They do not change in an experiment.

Directions: Drag and drop these highlighter strips to identify the variable in each example.

Independent Variable	Dependent Variable	Control Variable
Students were given 10 minutes to complete the puzzle.	They did not know if it would be too hard to complete the puzzle.	
An investigation was run in a classroom. A battery and a wire wrapped around a nail. Different sizes of nails were used.	The number of paperclips the electromagnet could pick up was measured.	
You are running an experiment in science to see which bubble gum has the largest bubble. You choose four types of bubble gum and chew each piece 50 times, then blow bubbles and measure them.		
You drop a thermometer on a string into a pond at 3 feet, 6 feet and 10 feet to determine if the temperature of water changes when the water is deeper.		
You set up 3 pots of water. One at 40 degrees celsius, one at 60 degrees celsius and one at 80 degrees celsius. You put a corn seed in each pot to test whether corn seeds will sprout at different times depending on the temperature of water they're placed in.		
You take three students and encourage one student to study 10 minutes for a test, the other studies 20 minutes and the third studies for 30 minutes. They each take the same test to determine if amount of time spent studying for a test affects the test score.		

INPUT

OUTPUT

2

ENGAGE
Provide students with phenomenon to view, consider or question.

Engage Introduce a phenomenon that is interesting, relevant and consequential so students develop a motivation to explain or figure out the science behind the phenomenon.

Topic:

Directions: In the Visit section, visit the website by clicking the link. In the View section, click the link to the video featuring a phenomenon. Then, read the information.

View

QFT

As phenomenon are introduced, students summarize the phenomenon & begin to engage through Question Formulation Technique, activating prior knowledge or other strategy.

QFT

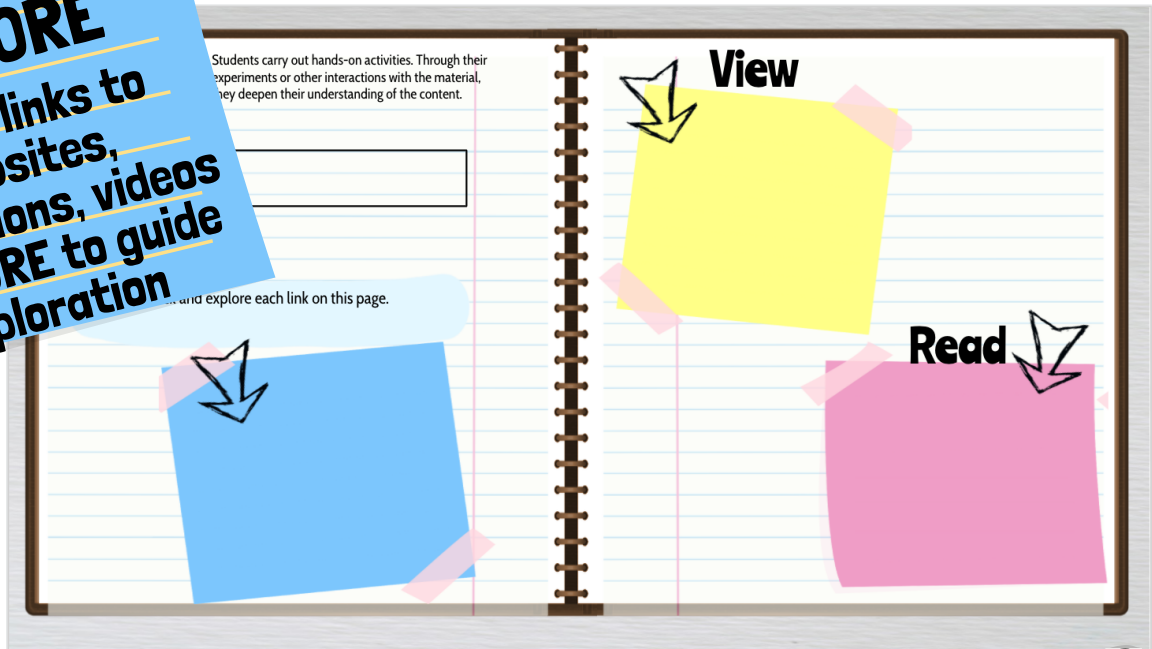
Tips and Guidelines (Continued)



3

EXPLORE

Insert links to websites, simulations, videos and MORE to guide exploration



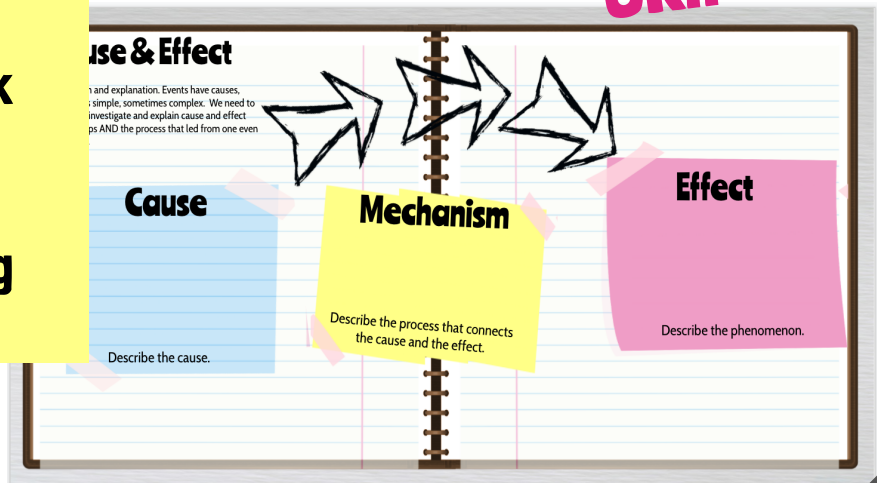
HOWEVER.....DON'T OVERLOAD YOUR PAGES!!



For students working remotely, unnecessary images on the page can put a strain on bandwidth and slow down loading. Additionally, special education students benefit from pages with a lighter information load.

Blank space is OK!!

Students need ROOM to record their work....the notebook should be a demonstration of THEIR understanding



Tips and Guidelines (Continued)



4

EXPLAIN

Use text, videos and websites to help explain concepts

...page below. Then, drag and drop the ... columns based on what you read.

... in contact with them on a daily basis. Some ... sound waves, radio waves and microwaves! A wave is ... that carries energy from one location to another.

... are types of waves: Electromagnetic waves and Mechanical Waves.

Electromagnetic waves are waves that can travel through outer space. Light waves, x-rays and radio waves are examples of electromagnetic waves.

Mechanical waves are waves like sound waves, waves in water and even the seismic waves created by an earthquake. These waves need a medium (like air or water or the ground) to travel through to transport their energy. Mechanical waves cannot travel through outer space.

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    graph TD
      A[Can travel through outer space] --- B[Needs a medium to travel]
      A --- C[Cannot travel through outer space]
      B --- D[Sound Waves]
      C --- E[Ocean Waves]
    
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Electromagnetic Waves **Mechanical Waves**

Add interactive OUTPUT components to help assess understanding

5

ELABORATE

Choice boards are a GREAT way for students to expand their understanding

Science Vocabulary Choice Board

<p>Define It!</p> <p>Chose 6 vocabulary words. Look up the definition to each word THEN rewrite it in your own words.</p>	<p>Draw It!</p> <p>Chose 6 vocabulary words. Locate (or draw) a picture of each word.</p>	<p>Use It!</p> <p>Chose 6 vocabulary words. Use each word in a unique sentence.</p>
<p>Riddle Me This!</p> <p>Write riddle clues to 6 vocabulary words. The last line of the riddle should say "what am I?"</p>	<p>Clip It!</p> <p>Write a newspaper article using Foddy Generator. Include 6 vocabulary words in the article. Copy/Paste the article image onto the page.</p>	<p>Text It!</p> <p>Discuss 5 vocabulary words in a text using https://www.classtools.net/SMS/. Save the text and insert the URL to the texting conversation onto the page.</p>
<p>In a Flash!</p> <p>Use the Digital Flash Card deck to make flashcards for 6 of your words. Share the link to the deck.</p>	<p>Criss Cross</p> <p>Using Discovery Puzzle Make: create a crossword puzzle out of 6 vocabulary words.</p>	<p>Oh Dear!</p> <p>Write a letter to a person of your choice. Use 6 of your vocabulary words in the letter. Be sure to underline each vocabulary word in your letter.</p>

✓ Directions: Select one item from checkmark next to the task you below.

Tips and Guidelines (Continued)

6

EVALUATE

Link to Google Forms, Digital Exit Slips or include your own response elements to evaluate understanding

Claim → **Evidence** → **Reasoning**

Claim
 What is your claim? Directly answer the question here!
 Sentence Starters
 • It is evident that
 • It is true that
 • ... cannot
 • The effect that ... has on ... is

Evidence
 WHAT evidence did you measure or observe that supports this claim? Scientific data is reported here!
 Sentence Starters
 • The following data was collected
 • When I measured
 • I collected
 • The graph shows
 • Item one has a measurement of ... Item two has a measurement of ... this demonstrates

Reasoning
 WHY does the evidence connect/explain you?
 Sentence Starters
 • The data illustrates
 • It is clear that
 • This proves that
 • Based on this evidence
 • The evidence supports

Investigation

1. What is the question that I need to find an answer to?
Question

Materials: Description of Investigation:

2. What are your variables? List AS MANY AS YOU CAN THINK OF here. A variable is any factor, trait, or condition that could possibly impact the outcome of the investigation.
Variables

3. What is your INDEPENDENT variable? (What are YOU going to change?)

4. What is your DEPENDENT variable? (What are YOU going to measure as a result?)

5. What are your **Control** variables? (What are possible things that could vary that you've controlled to make them the same?)
Control

Summarize

7

Self-Assess

Allow students opportunities to **CREATE** content in the notebook to develop it as their own resource tool and reflect on their learning

Reflection Sentences

Topic:

Consider the topic above. Then, answer each of these reflection sentences.

I learned...

I'm beginning to wonder...

I was surprised...

I don't understand...

I rediscovered...

I now realize...

I would someday like to (related to topic)...

I would like to find out more about...

A question I have...

AHA Connections

Lightbulb icons for connecting ideas.

5E Instruction

Engage

Introduce a phenomenon that is interesting, relevant and consequential so students develop a motivation to explain or figure out the science behind the phenomenon.

Purpose/Goals

- determine students' current understanding about the phenomena
- invite students to raise their own questions about the process of scientific inquiry (QFT)
- encourage students to compare their ideas with those of others
- enable teachers to assess what students do or do not understand about the stated outcomes of the lesson.

Instructional Strategies

- Show a compelling video segment
- Discuss "big ideas" or concepts that students can relate to
- Pose big questions with complex explanations
- Sort and identify commonalities between items
- Present data that drives questioning

Explore

Students carry out hands-on activities. Through their experiments or other interactions with the material, they deepen their understanding of the content.

Purpose/Goals

- interact with materials and ideas through classroom and small-group discussions
- consider different ways to solve a problem or frame a question
- acquire a common set of experiences so that they can compare results and ideas with their classmates
- observe, describe, record, compare, and share their ideas and experiences
- express their developing understanding (modeling) of testable questions and scientific inquiry

Instructional Strategies

- Station work to explore components related to a larger idea
- Developing models
- Designing solutions using engineering design practices
- Conducting investigations and gather data
- Developing explanations for phenomenon Simulations

Explain

This is a teacher-led phase that helps students synthesize new knowledge and ask questions if they need further clarification.

Purpose/Goals

- explain concepts and ideas (in their own words)
- listen to and compare the explanations of others with their own
- become involved in student-to-student discourse in which they explain their thinking to others and debate their ideas
- revise their ideas; record their ideas and current understanding
- vocabulary formally introduced, when appropriate
- use labels, terminology, and formal language
- compare their current thinking with what they previously thought

Instructional Strategies

- Video explanations
- Gallery Walks
- Socratic Discussions
- Worksheets/practice problems
- Guided notes

5E Instruction

Elaborate

Forging the concept-to-self, concept-to-concept and concept-to-world connections that help tie anchor and investigative work together.

Purpose/Goals

- make conceptual connections between new and former experiences
- connect ideas, solve problems, and apply their understanding to a new situation
- use scientific terms and descriptions
- draw reasonable conclusions from evidence and data
- deepen their understanding of concepts and processes
- communicate their understanding to others.

Instructional Strategies

- Writing a Claim, Evidence, Reasoning report
- Creating a report on investigations
- Discussing solutions to engineering design challenges
- Creating finalized notes/claims based on models
- Creating extension projects
- Sharing/discussing results with peers
- Playing games
- Simulations

Evaluate

Students compare their previous understanding to their new knowledge. They are able to prove what they know in writing, conversation, and demonstration.

Purpose/Goals

- demonstrate what they understand about scientific inquiry and how well they can apply their knowledge to carry out their own scientific investigation and to evaluate an investigation carried out by a classmate
- share their current thinking with others
- assess their own progress by comparing their current understanding with their prior knowledge
- ask questions that take them deeper into a concept.

Instructional Strategies

- Projects
- Traditional assessment/quizzes
- Exit Slips
- Self-Reflection
- Peer Evaluation
- Presentations
- Investigative Reports