Science Notebook Guide

Purpose of Science Notebook

A scientist's notebook is a detailed record of his or her engagement with scientific phenomena. It is a personal representation of experiences, observations, and thinking—an integral part of the process of actively doing scientific work. A scientist's notebook is a continuously updated history of the development of scientific knowledge and reasoning. It is a place where students formulate and record their questions, make predictions, record data, procedures, and results, compose reflections, and communicate findings. Most importantly, notebooks provide a place for students to record new concepts they have learned.

For Students, engaging in active science involves experiences and making sense of the experiences. Science notebooks help students with the sense-making part. They assist with documentation and information organization as students create simple tables, graphs, charts, drawings, and labeled illustrations as standard means for representing and displaying data. Science notebooks also assist students with cognitive engagement. As data is recorded and organized in an efficient manner, students use it to draw conclusions about the way the world works. Their data, based on their experiences and observations, are the raw materials that students use to forge concepts and relationships. A major goal for using notebooks is to establish habits that will enable students to collect data and make sense of it.

For teachers, notebooks are tools for gaining insight into students' thinking. Notebooks inform and refine instructional practice. They can be used to assess student's science practice skills as well as measure the quality and quantity of student's learning. It's an excellent medium for providing feedback to individual students regarding their work. Notebooks can acts as a focal point for discussion about students' learning at several levels and provide insight on refining teaching practices to improve instruction.

Science Notebook Formats

Students can create their entire science notebooks from blank pages in bound composition, spiral or three-ring binders. Students generate their own notebook entries with the option of inserting district approved duplications into them. This type of notebook is most optimal and will require modeling by the teacher to provide enough structure to make the notebook useful.

Or

Teachers can create student notebooks using the duplication masters provided in the *Teacher Resources* binder of the FOSS *Teacher Toolkit. D*uplication masters can be bound into consumable notebooks for students to use. This type of notebook ***should be reserved primarily for kindergarten students and as a differentiation tool for first and second grade students*** until they can transition to the student created notebook.

Science Notebook Organization

Organizational elements are used to streamline access to the contents of student's notebook over time to support their learning. As teachers consider what elements of a science notebook are most appropriate to meet their student learning goals in science, they will need to exercise their own professional judgment as to which organizational elements support those goals. Formats for each organizational element vary depending on grade level and purpose, but can include some of the following components:

Cover Page

The cover page should include the student's name, school, teacher's name and class room number. Recording this information enhances student understanding of common text features that support the development of literacy skills.

First Page

Students should generate a "Science Is… page' that expresses their thoughts or feeling towards Science. Examples of for this page would be; student interpretation/drawing of a scientists, picture and or poems about science, etc.

Table of Content

The first two-four pages of the notebook should be reserved for the table of content. Students may need to be reminded to add to it systematically as you proceed through the module. The table of contents can be based on the names of the investigations in the module, the specific activities undertaken, the concepts learned, or some other schema that makes sense to everyone. As a modification when needed, teachers may provide students with a template or preprinted table of contents without page numbers. As students work through each investigation, they record the relevant page numbers in their table of contents. Common elements of a table of contents may include:

- Date
- Title of activity
- Page number
- Initials (Teacher and Student)

Page numbering and Documentation

Each page should be pre-numbered front and back. These can be referenced in the table of contents as the notebook progresses.

Documentation Date and Time

As entries are made, each page should include the date and time of the entry.

Index or Glossary

Vocabulary acquired while students are engaged in hands-on investigations, contribute to the development of scientific literacy. To support to students in building understanding of scientific terminology it is important that students maintain in index in their science notebooks. The index should be located at the back of the notebook and have a block of letters assigned to several index pages (A–F, G-L, etc.). Students write the new vocabulary word or phrase in the appropriate square and tag it with the number of the page on which the word is defined in the notebook.

Four mandatory organizational components of the notebook that must be planned from the outset are: ***table of contents, page numbering, documentation, and an index***. For kindergarten and first grade classes, the use table of contents and index should be modeled in the **class notebook**.

Notebook Components

As students engage in scientific exploration and learning, they will make entries in their notebooks. Students should be encouraged and instructed to use many means of recording and communicating besides writing, including charts, graphs, drawings, color codes, numbers, and images attached to the notebook pages.

Organization of Entries
These features allow students to organize their work and more efficiently access learning from prior activities or lessons. These features also assist the teachers in assessing student understanding. Common organizational features include:

- Page numbers
- Date
- Headings (e.g. focus question, vocabulary, prediction, data, results, claims and evidence, etc)
- Documentation of authentic student work
- Time (e.g. time observations made, elapsed time for activity) ***optional***

General components are necessary to the conceptual shape and direction of scientific notebooks. Investigations generally start with a question or challenge, and then proceeds with an activity, data acquisition, sense making, next steps and new questions. The science notebook should record important observations and thoughts along the way. Sample set-up attached. Various types of science notebook entries are recommended:

Science Notebook Entry Types

Entry Type	***Definition and Purpose***
Investigation	*Definition* Scientific investigation is the way in which scientists and researchers use a systematic approach to answer questions about the world around us. They generally follow this process: *Focus Questions* The focus question establishes the direction and conceptual challenge for the activity. *Plan and Procedures* The planning of investigation may be detailed or informal, depending on the requirement of the investigation. They take time to develop and document. *Predications:* Students may be able to make a prediction as they attempt to relate prior experiences to the question posed. *Data:* Data are the bits of information (observations) from which scientists construct ideas about the structure and behaviors of the natural world. Data records should be accurate and precise, clearly related to the focus question; and organized for efficient referencing. *Analyzing Data:* Students must establish the habit of making sense of the data collected and using it as evidence to explain their thinking. *Conclusions:* At the end of an investigation (major conceptual sequence), it may be

	appropriate for students to generate a summarizing narrative to succinctly communicate what they have learned. *Next Steps/New Questions* The outcome of science investigation should stimulate students to think of new or extended questions that they would like to investigate. Students should be encourage to record these questions framing them as investigable questions.
	Purpose Students use investigation formats to guide their thinking and writing while they design and conduct investigations. Students also use these formats to reflect on and discuss their findings and ideas.
Drawings	*Definition* Student generated drawings of materials, scientific investigation set-up, observations, or concepts. Three common types of drawings used in science notebooks include: *Sketches:* Informal pictures of objects or concepts created with little detail. *Scientific Illustrations:* Detailed, accurate, labeled drawings of observations or concepts. *Technical Drawings:* A record of a product in such detail that someone could create the product from the drawings.
	Purpose Students use drawings to make their thinking and observations of concrete or abstract ideas visible. Drawings access diverse learning styles, allow entry to the writing process for special needs students and emergent writers, and assist in vocabulary development (e.g. oral explanations, group discussions, labels).
Tables, Charts, and Graphs	*Definition* Formats for recording and organizing data, results, and observations.
	Purpose Students use tables and charts to organize information in a form that is easily read and understood. Recording data in these forms facilitates record keeping. Students use graphs to compare and analyze data, display patterns and trends, and synthesize information to communicate results.

Graphic Organizers	*Definition* Tools that illustrate connections among and between ideas, objects, and information. Examples include, but are not limited to, Venn diagrams, "Box–and-T" charts, and concept maps.
	Purpose Graphic organizers help students organize ideas to recognize and to communicate connections and relationships.
Notes and Practice Problems	*Definition* A record of ideas, observations, or descriptions of information from multiple sources, including but not limited to direct instruction, hands-on experiences, videos, readings, research, demonstrations, solving equations, responding to guiding questions, or developing vocabulary.
	Purpose Students use notes and practice problems to construct meaning and practice skills for current use and future reference.
Reflective and Analytical Entries	*Definition* A record of a student's *own* thoughts and ideas, including, but not limited to initial ideas, self-generated questions, reflections, data analysis, reactions, application of knowledge to new situations, and conclusions.
	Purpose Students use reflective and analytical entries to think about scientific content from their *own* perspective, make sense of data, ask questions about their ideas and learning processes, and clarify and revise their thinking.
Inserts	*Definition* Inserts are artifacts placed within a notebook, including, but not limited to photographs, materials (e.g. flower petals, crystals, chromatography results), and supplemental readings (e.g. newspaper clippings).
	Purpose Students use inserts to document and to enrich their learning.

Supporting Students

Students need to have successful experiences with notebooks. Different supportive structures can help transform notebook into a valuable reference tool. These supports and scaffolds can be used with the whole class, a small group, or an individual and should be adjusted to meet students' needs.

A class notebook can be created using chart paper tablets, paper notebook displays under document camera or smart-boards displays etc, to introduce strategies, write a summary statement and document investigations, as a way to model the various notebook components. The class notebook should be accessible at all times for students to reference.

Scaffolds can be used to provide structure to a notebook entry. They should only be made available for students when the student needs them. They will vary from student to student and from investigation to investigation. Scaffolds include:

- **Sentence starters** or drawing starters provide a beginning point for a notebook entry.
  Example: What really surprised me was…

- **Sentence frames** are used to focus and organize and prompt student's thinking. They help students become more proficient in scientific writing and less reliant upon the prompts.
  Example: I claim that a _____ helps _____ because _____.

- **Duplication Masters** can guide students thinking and help them collect data with a table, graph, or list of questions.

Think-Alouds can help students verbalize their thoughts and explain their decision-making process for particular notebook entries.

Providing students with time and prompting them to record observations and notes within active engagement can help student fully document their discoveries.

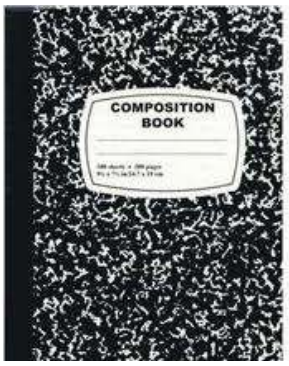
Teacher Feedback

Students' writing often exposes weaknesses in students' conceptual understandings, inaccuracies in communications of understandings. It's important to use the notebook to provide specific feedback that guides students to think about the content of their work. Give suggestions for how to improve, ask for clarification or additional information. Attach a self-stick note, which can be removed after the student has taken appropriate action. When students return to their notebooks and respond to the feedback, additional information will be exposed that will help in discriminating between knowledge and communication difficulties.

Mandatory (Minimum) Notebook Requirements

Notebook writing is viewed as a critical aspect of science teaching and learning. ***All students must*** maintain an organized science notebook making routine scientific entries throughout the entire school year. Science notebooks must contain authentic student work detailing students' scientific educational experiences. Students must formulate and record their questions, make predictions, record data, procedures, and results, compose reflections, communicate findings, record new concepts, etc.

Science Notebook Organization at a Glance



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Title Page or Notebook Cover

Recording this information enhances student understanding of common text features that support the development of literacy skills. Common elements on a title page or notebook cover may include:

- Student name
- School
- Teacher name
- Class

Table of Contents

A table of contents allows a student to easily retrieve work from previous lessons. Student can create the table of contents themselves or teachers can create a template to be filled in (e.g. blank template or transparency, list of activities with place to enter page number and date). Common elements of a table of contents may include:

- Date
- Focus Question/ Investigation/Title
- Page #
- Student Initial
- Teacher Initial

Organization of Individual Pages

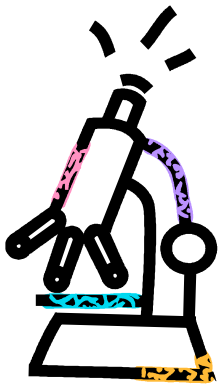
These features allow students to organize their work and more efficiently access learning from prior activities or lessons. These features also assist the teachers in assessing student understanding. Common organizational features include:

- Number on each page
- Headings
- Focus questions
- Activity title
- Date each page
- Time (optional)
- Page division (due to specific content needs)
- Sections

Index/Glossary

Vocabulary words acquired while engaged in a hands-on lesson contribute to the development of scientific literacy. The use of an index/glossary builds understanding of scientific terminology, while advancing learning of text features. Some strategies for constructing glossaries include:

- A block of letters assigned to several index pages (A–E, F–K, etc.).
- Students write the new vocabulary word or phrase in the appropriate square and tag it with the number of the page on which the word is defined in the notebook.
- Teacher and student creates index/glossary based on input from students



Science Notebook Investigation Format at A Glance

Focus Question: Students need to identify, write and analyze questions that can be answered by conducting scientific experiments.

Writing Scaffold: How does…? How can…?

Example: How can a lever be used to make work easier?

New Vocabulary: New vocabulary needed to better understand scientific concepts. New vocabulary should be listed and used in student explanation and writing.

We will "Speak" the language of science and be specific.

Previous Knowledge: Reflection of what students already know or have observed. This can be developed orally, or with a KWL, chart, free write etc. Reflecting on previous knowledge is foundation scientists build from.

Writing Scaffold: I remember when _____

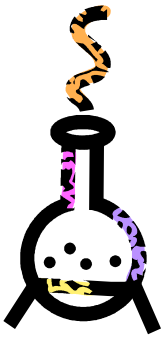
Example: I remember a time when my dad tried to lift a large rock in the yard. He couldn't pick it up so he used a shovel to roll it in to place.

Prediction: A statement that defines what you think the outcome of your investigation/experiment will be.

Framing Scaffold: I predict that _____ because_____.

If _____ then_____ because _____.

Example: I predict that a lever can be used to decrease the force needed to do work by/because…



Plan and Procedures: Students plan their investigation. The planning may be detailed or informal, depending on the requirement of the investigation. A brief class discussion of the procedure may lead to a sentence or two recorded in the class notebook.

Data/Accurate Records: Collect and record and analyze evidence from your investigation.

Examples: Tables, labeled drawings, graphs, written observations, etc.

Claims and Evidence: Students use evidence to analyze descriptions, explanations, predictions, and models so that they can communicate scientific procedures and explanations.

Framing Scaffold: I claim that _____. I claim this because _____

Conclusion: How were your predictions supported by the evidence or how would you revise/change your thinking based upon the evidence? What did you learn from this investigation?

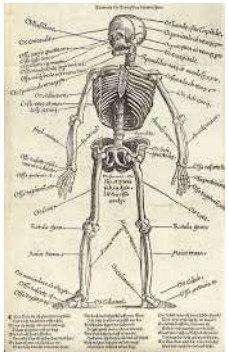
Writing Scaffold: The evidence supported /did not support my prediction because _____

Reflection: Students think about:

Writing Scaffold: Questions that I still have are_____

What really surprised me was_____

I want to learn more about_____



Scientist Notebook Reflection and Feedback Sheet

Think as a Scientist
Record as a Scientist
Reflect as a Scientist

Scientist Notebook Organization Rubric 4 excellent 3 good 2 fair 1 poor			
	Evidence	**Student Score**	**Teacher Score**
Table of Contents	• All entries are included to-date • All dates and page numbers written		
General Organization	• titles/headings • dates • page numbers • overall neatness		
Written Entries and Reflections			
Focus Question	• Relates to scenario. • Cannot be answered yes or no • Investigable		
Prediction	• Answers the problem/Focus Question • Uses "because", supports your opinion		
Data	• Labeled drawings and collected evidence for each parts of the investigation		
Claims and Evidence	• Claims and evidence statements related to guiding questions • Thorough • Show evidence of understanding the topic • Include main ideas • Give details		
Conclusions	• Prediction revisited and affirmed/revised • "Today I learned" statement		
Reflection:	• Responds to at least one of the stems • "What really surprised me about… was..." • "A new question that I have about… is..." • "I wonder if ..."		
Total			

Comments and Next Steps:

Sample Table of Content Template

Date	Focus Question/Investigation/Title	Page #	Student Initial	Teacher Initial

Sample Index Template

Index A-F

Index G-L

Index M-R

Index S-Z