Creating the Science Notebook: A Tool for Evaluating Student Work

Elementary

Table of Contents

Designing the Science Notebook for Grades 2 - 5

There are many ways to construct a science notebook. The following are suggestions for one method of assembling an effective notebook for elementary students in grades 2 - 5.

1. The hard cover composition books seem to work the best and last an entire school year without falling apart. Spirals can also be used, but the ones with perforated pages may not be effective, as the pages tear out easily.

2. On the inside front cover, glue a version of the Science Notebook Guidelines (see p. 21). Note: Printing handouts two per page allows the complete page to fit in a composition notebook without folding.

3. Leave the next three pages in the science notebook blank. Page ‘i’ is for a Title Page, and pages ‘ii’ and ‘iii’ are for a Table of Contents (see page 9).

4. Page 1 is where students glue a copy of the Scientific Processes for Simple Experimental Investigations (Grade 5) or Processes for Descriptive Investigations for Grades 1–5 (see pages 10–11).

5. Page 2 is for the tools students will learn how to use (see pages 12–18).

6. Page 3 is for information about measurement (see p. 20).

7. Other pages could be used for grading rubrics (see p. 24) or formula charts.

8. Pages at the back can be used to create a resources section or a glossary.

9. On the inside of the back cover, glue the Safety Contracts/Rules (see p. 22–23).

(Inside Cover)

Science Notebook Guidelines

(Title Page)

Amy’s Science Notebook

ABC Elementary

2013–2014

Grade 4

Table of Contents

Date Activity Title Page

ii

Table of Contents

Date Activity Title Page

iii

Page 1
Scientific Processes (Grade 5)
(for Simple Experimental Investigations)

Problem

Hypothesis

Materials

Procedure

Data

Results

Conclusions

Applications

Page 1
Scientific Processes (Grades 1–5)
(for Descriptive Investigations)

Ask questions

Make inferences

Select and use appropriate tools

Observe

Describe

Compare and contrast

Graph

Illustrate

Measure

Investigate

Page 2
Tools I Will Learn How to Use

Students have pictures of the tools they will learn to use at their grade level (per TEKS). One strategy could be: after students have used the tool and understand its use, they can put a “check” by it. By the end of the year, all tools should be “checked off.”

Page 3
Measurement Information

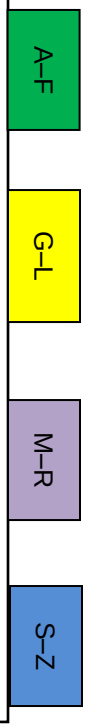
This page can be used to emphasize measurement. Measurement is an ongoing process, and most students need continual practice throughout the year.

Optional Pages at the

Back of the Notebook:

Glossary/Personal Word Wall

Each of the tabbed sections could have 3–4 pages depending upon grade level. Students can list terms and/or definitions. Some teachers list the term and the page number where the information can be found in the notebook (index).



Inside of the Back Cover

Safety Contract
or
Safety Rules:

The Primary (K–1) Science Notebook

Students in Kindergarten and grade 1 are able to keep a science notebook; however, the primary science notebook may be constructed and kept in a different format than other grades. Young students may need more guidance in creating their science notebook entries. Additionally, student records will include more nonverbal entries. When students add a written/verbal component, the teacher may consider providing a word bank. Modeling how to complete a science notebook entry can also be accomplished through shared writing by using a large classroom or flip chart. Class rules and other procedures can be kept on the flip chart.

Customized notebooks can be created for each unit of study in several ways. These are especially helpful for Kindergarten students as units can be sent home upon completion:

- Assemble several sheets of plain paper, lined paper, or primary writing/story paper, and then, cover with a construction paper cover and staple.
- Place hole-punched paper into a three-pronged folder.

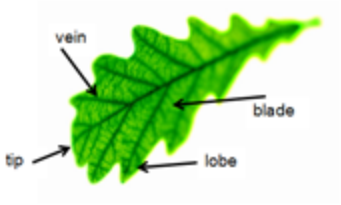
Additionally, an anchor chart could be created to display in the classroom (see p. 7). The chart reminds students of four components they should consider during a science investigation or activity.

Communicating in a science notebook provides students the opportunity to record their understanding, reflections, and questions. Sentence stems or cloze sentences are ways to support student writing as language is developed. A word bank with possible science terms used in the unit provides support for emergent language learners.

Entries in our notebook should include…

Ask a question. What i s a leaf?

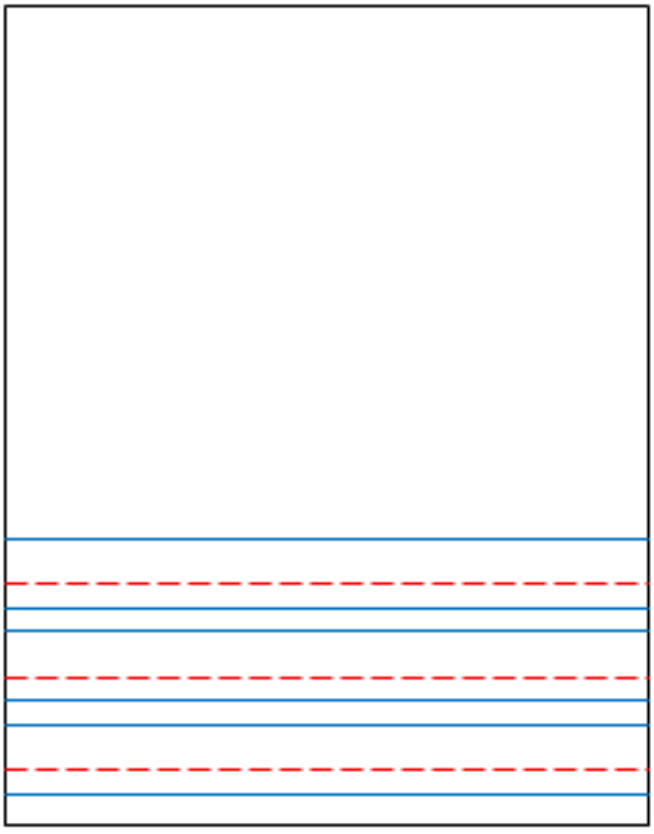
Create a diagram or drawing.



Label the diagram or drawing.

Describe the object or organism. The leaf is green, lobed and 10 cm long. There is one vein down the center of the leaf and a vein going to each lobe. The leaf feels smooth.

Sample Anchor Chart



Primary Writing/Story Paper

Possible Templates for Science Notebooks

Notebook Labels

Science Notebook

Name

School Year

Science Notebook

Name

School Year

Science Notebook

Name

School Year

Science Notebook

Name

School Year

Science Notebook

Name

School Year

Science Notebook

Name

School Year

Table of Contents

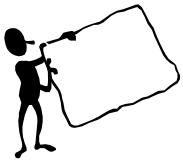
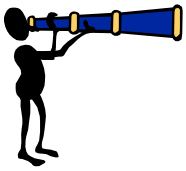
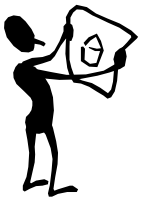
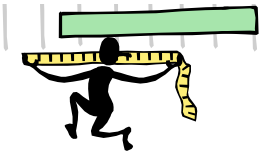
Scientific Processes

(for Simple Experimental Investigations - Grade 5)

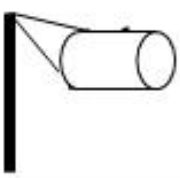
Problem 	• The question we want to investigate.	**Problem** 	• The question we want to investigate.
Hypothesis 	• One possible answer to the problem or question. • A statement about the expected outcome based on observation, knowledge, and experience. • Written as an "If…then…" statement.	**Hypothesis** 	• One possible answer to the problem or question. • A statement about the expected outcome based on observation, knowledge, and experience. • Written as an "If…then…" statement.
Materials 	• The equipment or tools needed to test the hypothesis and answer the problem or question.	**Materials** 	• The equipment or tools needed to test the hypothesis and answer the problem or question.
Procedure 	• The steps you will follow to do your investigation. • The method you will use to gather and record your data.	**Procedure** 	• The steps you will follow to do your investigation. • The method you will use to gather and record your data.
Data 	• Gather data. Observe and measure carefully. • Record and organize your data so that you can learn from it. • Display data in tables, charts, or graphs. Use clear labels.	**Data** 	• Gather data. Observe and measure carefully. • Record and organize your data so that you can learn from it. • Display data in tables, charts, or graphs. Use clear labels.
Results 	• Record the results of the investigation using pictures and words.	**Results** 	• Record the results of the investigation using pictures and words.
Conclusions 	• Write a conclusion. • Describe the claims and evidence you used to determine whether your test supported your hypothesis.	**Conclusions** 	• Write a conclusion. • Describe the claims and evidence you used to determine whether your test supported your hypothesis.
Applications 	• How could the information be applied in another situation?	**Applications** 	• How could the information be applied in another situation?

Scientific Processes

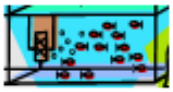
(for Descriptive Investigations – Grades 1–5)

Ask questions 	Use charts and graphs to display data 
Make inferences 	Describe in pictures, numbers, and words 
Select and use appropriate tools 	Observe 
Investigate 	Illustrate and label 
Measure 	Provide claims and evidence 

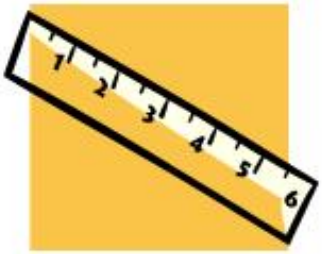
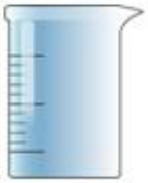
Grade 1: Tools I Will Learn How to Use

Computer		Hand lens	
Balance		Cup	
Bowl		Magnet	
Collecting net		Notebooks	
Timing device		Clock	
Non-standard measuring Items		Safety goggles	
Demonstration thermometer		Wind sock	

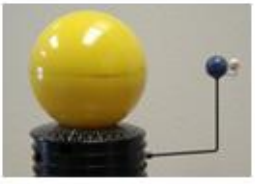
Grade 2: Tools I Will Learn How to Use

Computer		Hand lens	
Ruler		Balance	
Plastic beaker		Magnet	
Collecting Net		Notebooks	
Safety goggles		Clock	
Stop watch		Thermometer	
Wind vane		Rain gauge	
Materials to support observation of habitats such as terrariums		Materials to support observation of habitats such as aquariums	

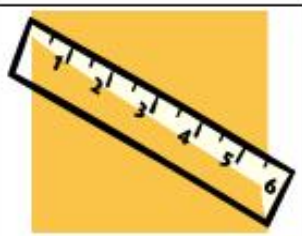
Grade 3: Tools I Will Learn How to Use

Microscope		Camera	
Computer		Hand lens	
Metric ruler		Celsius thermometer	
Wind vane		Rain gauge	
Balance		Graduated cylinder	
Plastic beaker		Spring scale	

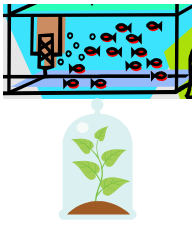
Grade 3: Tools I Will Learn How to Use (cont'd)

Hot plate		Meter stick	
Compass		Magnet	
Collecting net		Notebooks	
Safety goggles		Gloves	
Timing device		Clock	
Sound recorder		Earth, Sun, Moon system model	

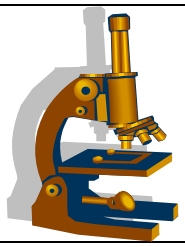
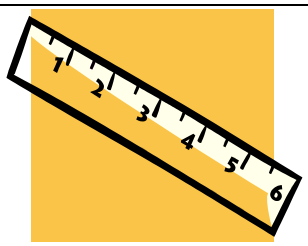
Grade 4: Tools I Will Learn How to Use

Microscope		Camera	
Computer		Hand lens	
Metric ruler		Celsius thermometer	
Calculator		Mirror	
Balance		Graduated cylinder	
Plastic beaker		Spring scale	

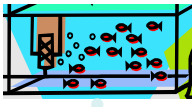
Grade 4: Tools I Will Learn How to Use (cont'd)

Hot plate		**Meter stick**	
Compass		**Magnet**	
Collecting net		**Notebooks**	
Safety goggles		**Gloves**	
Timing device		**Clock**	
Triple beam balance		**Materials to support observation of habitats such as terrariums and aquariums**	

Grade 5: Tools I Will Learn How to Use

Microscope		**Camera**	
Computer		**Hand lenses**	
Metric rulers		**Celsius thermometers**	
Calculator		**Mirror**	
Balances		**Graduated cylinder**	
Plastic beaker		**Spring scale**	

Grade 5: Tools I Will Learn How to Use (cont'd)

Hot plate		**Meter stick**	
Prism		**Magnets**	
Collecting nets		**Notebooks**	
Safety goggles		**Gloves**	
Timing device		**Clock**	
Triple beam balance		**Materials to support observation of habitats such as terrariums and aquariums**	 

Measurement Chart

We can Measure:	Tools to Measure:	Metric Units	Customary Units
time			
temperature			
volume			
capacity			
weight			
mass			
area			
linear measurement: length, width, height, perimeter			

Science Notebook Guidelines

Scientists use notebooks in the ways listed below:

- To record:
  - information and questions
  - data from investigations
  - drawings
  - observations
- To construct:
  - graphs, tables, and charts to organize information
- To reflect on experiences and identify new concepts
- To revise work as more knowledge is acquired

The following guidelines will help you create an interesting and informative notebook to show what you have experienced and learned in science.

- Write or print neatly.
- Title and date each entry.
- Keep a table of contents.
- Number the pages.
- Erase mistakes, or mark through them with one line; do not scribble or scratch out. (Please don't tear out pages of your notebook.)
- Label all drawings clearly.
- Use sentences and illustrations to clearly communicate your observations, plans, explanations, and conclusions.

Some sentence starters you may want to try:

I learned…

I still wonder about…

In what ways does this connect with…?

What if…?

This has me thinking about…

Could the outcome be changed if…?

I observed…

My investigation might be improved by…

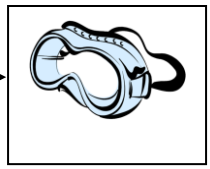
Safety Contract Grades K–2

Safety Rules

1. I will listen carefully. 

2. I will follow directions. 

3. I will wash my hands after science activities. 

4. I will keep myself and others safe. 

Safety Contract

I will be a responsible scientist.

_____ _____

Student Signature Date

_____ _____

Parent/Guardian Signature Date

_____ _____

Teacher Signature Date

Safety Contract Grades 3–5

1. I will act responsibly at all times during science activities.
2. I will follow the teacher's instructions and investigation procedures carefully.
3. I will wear safety goggles and protective clothing when instructed to do so.
4. I will tie back long hair, remove jewelry, and wear closed-end (both toes and heels) shoes when told to.
5. I will not taste, eat, drink, or smell anything during science class unless instructed to do so by the teacher.
6. I will tell the teacher if I see someone or something that is unsafe.
7. I know the class emergency plan.
8. I will immediately notify the teacher of any emergency.

The top part of the contract will be kept by the student and placed in their science notebook. After the appropriate signatures are in place, the bottom section of the safety contract will be kept on file by the teacher.

Safety Contract

I have reviewed these rules in class with my teacher and at home with a responsible adult. I agree to follow these rules and any additional instructions, written or verbal, given by the teacher or the school.

Student Signature:_____

Parent/Guardian Signature:_____

Teacher Signature:_____

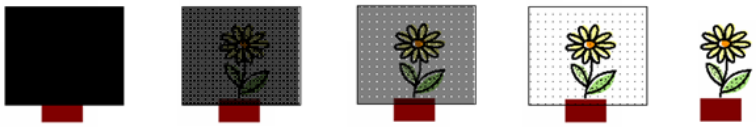
Scoring Rubric for Student Understanding

Proficient 4	Competent 3	Emerging 2	Beginning 1
Demonstrates understanding of unit/lesson concepts	Demonstrates understanding of most unit/lesson concepts	Demonstrates partial understanding of unit/lesson concepts	Demonstrates no understanding of unit or lesson concepts
Demonstrates understanding of unit or lesson vocabulary	Demonstrates understanding of most unit or lesson vocabulary	Demonstrates partial understanding of unit or lesson vocabulary	Demonstrates no understanding of unit or lesson vocabulary
Provides complete explanation for questions	Provides partial explanation for questions	Provides fragmentary explanation for questions	No response to questions
Drawing is complete and labeled with relevant detail	Drawing is scientifically labeled with some relevant detail	Drawing has incorrect, missing, or incomplete labels and little detail	No drawing

Instructor's Comments:

Student's Comments:

Experimental Design Guide
(See Grade 5 Unit 12 for full document)

Experimental Process		
Problem	Identify the Problem	• The first step in an experiment is to ask a well-defined, testable question when identifying a problem. The question must be clear and testable, which means that it must be measurable and controllable. • An example would be, "If plants are provided with light, then they survive longer than plants that are not provided with light." The problem, or question, we want to answer is: Do plants need light to survive? • A non-example would be, "Which plant is prettier?" This type of question would be difficult to control or measure.
Introduction	Form a Hypothesis	• This is where you make an educated guess and answer your question. Use the research that you have worked on to come up with a good hypothesis. With the hypothesis comes your prediction (*If* my hypothesis is correct, *then* these are the results that I expect...). Example: *If* plants can't grow in the dark, *then* the plants will die.
	Determine the Possible Variables	• In your experiment, you will be changing only one variable. • A variable is the part of the experiment you change or manipulate. After changing the variable, you then measure or compare the results to the control. • For example, placing plants in locations where different amounts of light are available.  • The "control" is the original plan with all of the conditions of the experiment. Everything in the experiment has to be constant. For example, with our plant experiment, the amount of water, air, humidity, noise, etc. all have to be the same, or constant. If they aren't the same, then you will have more than one variable, and your results will not be valid.

Experimental Process		
Procedure Materials	Design a Procedure	• The procedure is the exact and specific steps that you want to take as you conduct your experiment. It is important to follow the procedure to reduce extra variables and keep the controlled variable the same. • During the procedure, you must be very specific so that others can repeat your experiment exactly the way you conducted it. • It is important to repeat your experiment at least three times. These are called trials. After completing at least three trials, finding the average from your results will make them more reliable.
	List Materials	• List all of the materials that you will need to conduct the experiment. This includes safety materials that will be needed.
	Conduct Experiment	• Once you have your problem, hypothesis, variables identified, procedure, and materials approved by your teacher, you may conduct your experiment.

Experimental Design Guide
(See Grade 5 Unit 12 for full document)

Experimental Process

Results

Collect and Observe Results

- During your experiment, make sure to collect your results on a data table and graph. You may use Excel to help you create a data table and graph.

Example:

Data Table:

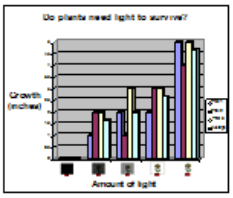
Amount of Light	Trial 1 (Growth)	Trial 2 (Growth)	Trial 3 (Growth)	Average (Growth)
				
				
				
				
				

Experimental Process

Results

Collect and Observe Results

Graph:



Discussion

Experimental Discussion

- Analyze, discuss, and write an interpretation of your results.
- Use data to back up your statements.
- Use your data to explain and interpret results.

Conclusion

Conclusion

- During your conclusion, ask yourself if your results supported your hypothesis. For example, "The hypothesis was supported by my data, because the more light that the plant had, the more it grew. The plant that did not have any light did not grow, it died."
- This is a good time to consider some problems that you might have had with your experiment.
- This is a good time to talk about other things that you learned and other possible experiments that you would like to conduct due to this experiment. For example, you might want to conduct an experiment about the importance of air to plants.

Experimental Design Approval Form
(See Grade 5 Unit 12 for full document)

		Experimental Process for _____ (Write the title of your experiment.)	Teacher Approval (For teacher only)
Problem	Identify the Problem	What are you trying to solve?	Approved: Notes:
Introduction	Form a Hypothesis	This communicates what you think will happen during the experiment. It is written in an If…then… statement. Example: **If** (the independent variable) is (increased, decreased, changed), **then** (the dependent variable) will (increase, decrease, change). **Your hypothesis:**	Approved: Notes:
	Determine Variables	**Variable:**_____ (This is the variable that you purposely change or manipulate. It will be the cause of the changes that you measure.) **Constants:** _____ _____ These are the variables that remain the same for all the trials.	Approved: Notes:
Procedures	Develop Procedures *Are all steps included (including safety precautions)? Are all materials and equipment listed? The procedure is written for **one** independent variable? You have included repeated trials? You have checked your writing for spelling and clarity?*		Approved: Notes:
Materials	List Materials		Approved: Notes:

Experimental Design Approval Form
(See Grade 5 Unit 12 for full document)

	Conduct the Experiment *Draw your set up in the space provided. Include labels and any observations.*		Approved: Notes:
Results	Collect Data and Observe Results Your results should include a statement about whether or not your data supports or does not support your hypothesis. Remember that in experimental design, we do not "prove" a hypothesis to be right or wrong.	Data: Graph:	Approved: Notes: :
Discussion	Experimental Discussion *Your group should discuss the results. In this section, you should include ideas for improving your design.*	I	Approved: Notes:
Conclusion	Write a Conclusion *In this section, you should write about why your experiment was important. Who could benefit from your results? Where could this information be applied?*		Approved: Notes:

Why Keep a Science Notebook: What the Research Says

Science notebooks are important as both organizational and reference tools for students. Through consistent use of a science notebook, students gain a better understanding of how one concept affects another. Furthermore, they begin to see the connections and relationships between the different science strands and between science, math, literature, social studies and art. Science notebooks improve students' vocabulary and communication skills. As thoughts are expressed through writing and/or illustrations, students learn, reflect upon, and understand science concepts and processes more clearly. Science notebook entries also provide both the student and the teacher with information about classroom experiences. Students' science notebooks mirror the notebooks that scientists in the field use as they gain a deeper understanding about the natural world. Through writing and drawing in science notebooks, students engage in authentic scientific thinking as they carry out their own investigations. Science notebooks include:

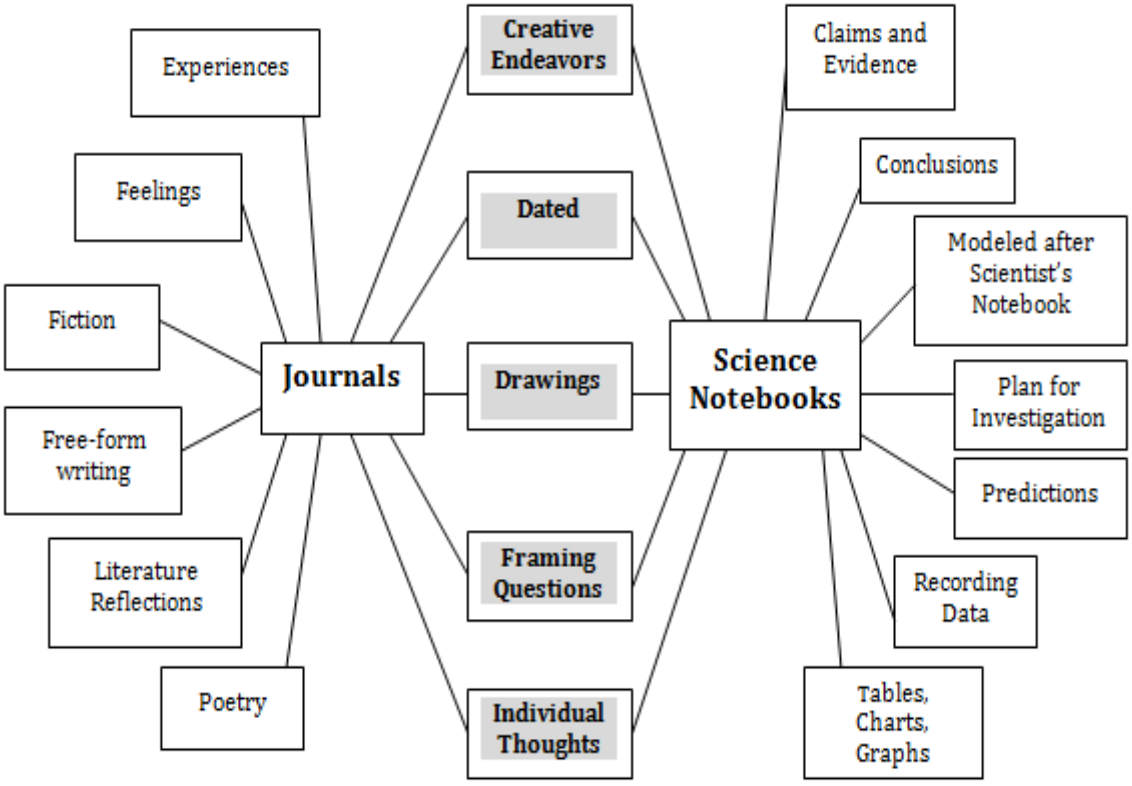
- a question to explore
- predictions
- claims and evidence
- a description of what was done
- what students have learned from their experiences

(Nelson, 2008).

In addition, science notebooks may incorporate narrative statements or drawings about the students' observations, data sets, diagrams, graphs, charts, and tables. Notebooks may also include statements or thoughts of how the student could apply what they have learned in another situation. Science notebooks can be used to help students develop, practice, and refine their understanding of science, while also enhancing reading, writing, mathematics, and communication. As students learn more information about a concept, they should be encouraged to add details to earlier entries.

Notebooks versus Journals

Science notebooks and science journals are terms that are often used interchangeably. Notebooks and journals *do* share some common characteristics, for example, both include questions and are creative); however, they differ in their format (Campbell and Fulton, 2003). Science notebooks focus on a more structured writing that follows an experimental, comparative, or descriptive investigation and the use of science process skills, whereas journals emphasize a more narrative form of writing that often expresses feelings. This writing is generally found in literature reflection, fiction, and poetry. Therefore, while it is important for students to learn how to use both types of writings, science notebooks and journals should be distinguished from each other and are usually maintained separately.



Evaluating Student Work

Science notebooks can have a positive impact on writing achievement. When science notebooks are used regularly to record reflections and personal records of work, then writing time in an authentic setting is increased. While these gains can be attributed in part to increased practice, much of the progress has to do with the *type* of writing in which students are engaged. Use of science notebooks is based on a model for *reflective writing*. Hampton (2012) states that reflective writing is evidence of reflective thinking. Students reflect on and communicate about an investigation, a demonstration, or other instructional information and consider the connections to their own lives and experiences. Engaging in authentic tasks allows students to connect to their work. Communication, whether written, drawn, or spoken, makes it easier to collaborate with other "scientists" in the class. The comparison of claims, evidence, and conclusions allows students exposure to other points of view. Whether collaboration is done by reading other students' notebooks or by discussing scientific information and investigations in small groups, communication is clearly enhanced. Some reflective writing questions could include:

- What happened?
- What is being investigated?
- What is the most interesting (or important, or useful) about the investigation or activity?
- What have I learned from this?
- In what ways does this connect to my life?

Notebooks as an Assessment Tool

Standardized tests provide information about what students know and can do at the end of instruction (usually at the end of the school year), but there is also an immediate need to regularly monitor student progress in order to drive best instructional practices. Science notebooks provide one form of formative assessment data. Science notebooks expose students' thinking and provide the teacher with important insights about students' understanding, possible gaps, and misconceptions.

Effective teachers continually assess their students' understanding of concepts; the Scoring Rubric for Student Understanding (p.24) provides a sample template for teachers and students to assess learning. The information learned from the rubric provides both teachers and students the opportunity to modify their work (Black, 1998). Rubrics can be effective teaching and learning tools if they are used in a timely manner, generally as the lessons on a concept are progressing. The feedback provided on the rubric by the teacher *and* the student allows both to reflect on the content understanding. Sadler (1989) suggests that the feedback on the rubric should include three components: the standard for achievement, the actual level of the student's achievement, and what the student needs to do in order to close any gaps.

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