

## ELEMENTARY SCIENCE NOTEBOOKS

As you skim through this document, think about purpose: are you deciding whether or not to begin using notebooks in your science instruction? Deciding which way to implement? Looking for ideas about improving the way you use notebooks? Before reading any further – identify ‘the why’ for now thinking about the role of notebooking. My ‘why’ for notebooking: I’ve seen how it provides a window into the mind of the learner. Student notes, when following the approach outlined here, are honest reflections of how this child thinks. I know what the child knows and what isn’t yet known. I can very easily modify (differentiate) a lesson to better match the learner’s needs so I can present appropriate learning challenges that develops that child’s intellect.

Another why: the research, verified by practice, that shows good science notebooking work equates to IMPROVEMENTS IN READING AND MATH skills. \*

### Each entry consists of 4 basic components

1. Question (which serves as the title)
2. Date
3. Drawings with labels (The Observations) – sometimes the drawings are supplemented with charts such as tabulated data.
4. Answer, to the question (AKA ‘conclusion’ – though I’ve found this word isn’t as helpful for younger elementary students).

(See a brief discussion on other things just before the Rubric).

### Why the focus on using a question for a title?

Titles are always questions, for two reasons. First, it gives a student a greater understanding of the work to be undertaken. It reminds them what they’re supposed to be focusing on (they do sometimes forget!). They learn they are not done until they have an answer – an important skill during any important task, particularly during high-stakes testing. “Did you answer your question?” is the norm instead of an argument about work being complete. Second, working with questions is a key science skill. Deciding on an effective question can be quite messy in the everyday life of real scientists. Knowing how to form an effective question is hard – many children don’t become proficient until 4<sup>th</sup> or 5<sup>th</sup> grade, or even later.

### Tips on working with Questions

Students do their best work when engaged and I start each lesson with a discussion to develop The Question. This discussion bridges full inquiry and guided inquiry (a bridge between teacher-directed and student-directed). It can take lots of practice to become proficient at this *instructional strategy*, one which is central to having a rigorous science program. To keep science teaching manageable, I most often have decided on the Q ahead of time and use brainstorming. It’s great IF a student comes up with a different version of the Q as long as it meets my pre-determined objective for the lesson. Here’s a way to support students through the grades:

- *K2 and early 1<sup>st</sup> grade*: Before announcing the Q, have a class discussion (if you are short for time, have a short discussion, but the discussion shouldn’t be skipped). Then, write a very short version of it and let them copy it at the top of the NB page. Write a short title and let them copy it.
- *1<sup>st</sup> and 2<sup>nd</sup> grade*: at the end of the discussion, write the agreed-upon Q on the board for them to copy.
- *3<sup>rd</sup> grade*: during the discussion, they suggest questions and I / we evaluate its clarity. We always discuss the best way of phrasing the question and edit to keep it succinct. I usually I write it on the board.
- *4<sup>th</sup> and 5<sup>th</sup> grade*: At the end of our discussion, they are expected to come up with their own questions. You will know progress is being made when the students naturally begin to ask for your input on the usefulness of their questions.

## Answers

The work is not done until students have written an answer, beneath all the other components, **in one complete, short sentence**. Some students struggle with clarity and they tell *everything* to be sure they 'have it right'. Other students have a real and serious issue with writing and can't/won't produce very much text. For these reasons (and more), I have come to insist on the answers being one short sentence. Most of their writing should be on the supporting details. The point about the necessity of responding to the question at hand is **not** obvious to many students. Each year, it sometimes takes months before I can stop routinely asking students if they have gone back to read their question to check if the answer responds to it.

## Drawing with labels

Most entries will have one or more drawings, which include labels. The drawings are a very effective communication tool and tell more about student thinking than will paragraphs. A student challenged with writing will quickly (within about 10 session) become proficient. Being a good scientist does NOT depend on having good writing skills, but one does need a way of keeping records and communicating with others.

This type of drawing is very different from *artistic* drawings. For example, emphasis, during animal observations, is to draw all the visible body parts of an animal in the correct number and location. The smaller details like exactness in shape and proportion may be somewhat 'off' and this is OK with elementary students. All significant AND relevant features *must* be labeled. (If you have difficulty deciding which details are significant or relevant, then consider having a more focused question.)

## Using Pens (and correcting mistakes)

Work should NEVER be erased or torn out. Mistakes should be simply lined-out. It helps to tell students that you will ignore the cross out and will not use it to evaluate the work. (It's very helpful to see what a student thought was a mistake. I've had students write something that pushes their learning and then they don't know what to make of it – and they decide it's wrong. Sometimes it just shows you how a student's thinking is developing.) *I have switched to using pens with all ages*. And this simplifies life in so many ways – no need for sharpening and no more requests for erasers. A set of about 100 is usually enough for a full year.

## Feedback

Notebooking's power also comes from its potential for giving explicit feedback in a very safe way. You can give the learner very exact ways to improve – ones which the learner understands. You simply identify what is missing OR what doesn't belong. Students willingly fix what is sensible and is understood.

Many teachers are reluctant to grade the drawings, as drawing could be considered an innate skill. However, these drawings are about including information – and that part is either included or is missing. If you collect samples over time, you will see dramatic improvements.

## Mini-Stampers

One important tool is mini-stampers, which are markers with a tip such as you would find on rubber stamps. Level 1 work receives 1 stamp, Level 2 receives 2 stamps, and so forth. This form of marking grades is *very* motivating to students. (I've heard it even works with high school students.) Students see that a L1 or L2 (or

GASP – no stamp) can be improved by providing the missing work - doing more work gets more stamps. And once a higher score is achieved, no mark remains of the previous low score. (Before working with the mini-stampers, students would change a 1 into a 4, and just stop working.)

When a major improvement is needed in the student work OR when I'm teaching a new skill that needs reminding, I grade work in progress: I make a "mad dash" around the room to stamp and give instant feedback. Usually, however, I grade the notebooks after the students are done with the assignment.

### **Improving work quality - Peer Review**

Sometimes the notebooks bog down and students (and maybe the teacher) are having a difficult time understanding how to use feedback to improve their work. Conducting a peer review of notebooks is effective at getting most learners unstuck. This involves students looking at each other's notebooks to see what works and what doesn't. The peer review is short – maybe 2 minutes (it will start out quiet and as soon as some noise develops take that as a signal that enough time has occurred).

Norms must be established so all students feel safe and participate fully, these are the norms found to be necessary:

- **All** notebooks left open to a particular piece of work (which is not yet graded)
- No touching of notebooks (such as looking at other pages)
- No talking while walking around the room (so no comments about a particular NB)
- Immediately after, students will have time change this particular notebook entry (This last piece is most important as it creates the reward for those who remain worried about the cost of exposure.)

### **Scoring Levels**

Feedback is based on a 4-point grading scheme. In Massachusetts, it matches the MCAS system. (In my classroom, complete assignments receive a Level 3 and a Level 4 is for work that exceeds the assignment in some significant way.) This rubric is written in terms students understand (a more detailed 4-point rubric, developed by teachers in Boston several years ago over a 3-year period of trial and revision, is included in the appendix):

Level 4 = you've given more than required/expected

Level 3 = you've given what was asked for/expected

Level 2 = you've given part of what was asked for/expected

Level 1 = little or no work pertaining to assignment

About spelling: I'm very clear that while spelling is important, I do not grade for it. I value more a student's willingness to take a risk in using language than is getting it all correct. I have yet to find that a student who doesn't want to spell correctly – and have found lots of students who will build confidence in their abilities BECAUSE of this decision. (This is posted in my room – and needs frequent re-visiting).

### **Record keeping**

It's important to use results from your assessment in deciding next steps for the teacher and the students. Summarizing your findings from grading on one sheet lets you see at a glance any patterns. The sheet I use is included in the appendix. It works because my assignments are constantly spiraling upward in complexity. I

frequently study the state's MCAS questions and the sample responses that they publish to ensure that I'm not expecting too little of my students.

### **Other Things to consider about structure**

1. Leave a few pages at the front (grades 3 and up) for a Table of Contents (plan for a future lesson on TOC once students have 4 or more solid entries – so they have something to organize); give them books with TOC to use as models
2. Page number all pages – starting with '1' (after the ToC section) and using the front and back of sheets (as in a 'real' book)
3. Name the last page Glossary (it will continue working forward), as in a 'real' book
4. Each investigation entry (usually each day's work) uses the same components and format (see below)
5. Other kinds of entries are possible (such as reflections or responses to reading)

### **Other components**

Once these basic parts are mastered, you can teach others. Consider these as extras, and OK to leave out (I find there is usually not enough time during class to be effectively used – and unnecessary for high levels of student achievement)

5. Materials list
6. Prediction (Please see comments about this below)
7. Questions for follow-up (after the Answer) (of these, this is the most important for learning)
8. ~~Hypothesis~~ – I teach this maybe ONCE and after grade 3, based on solid research.\* (It should *really* be avoided in elementary school. Many adults, including HS science teachers, do not understand its true meaning or its role. It isn't a part of the MA Science Learning Frameworks, as of 2009 – they are currently being revised.)

**Materials List** This list helps students in evaluating completeness of their drawings and other observations ("If it's in the list and not in the drawing, is your drawing complete?"). Lists are easy for students to compare amongst themselves. If time is always running short, you could consider this section optional most days.

**Predictions** When you are asked about what will happen – it is a guess if you really have little background or insufficient information. It is a prediction only when you have basic knowledge or some sufficient information. It is very unnerving to students when they are forced to make predictions in science work which is poorly known. (This usually results in many of the students changing their predictions.) Predictions will really be OK only for some of the class work.

## Appendix A

STUDENT NAME: \_\_\_\_\_  
 QUESTION: \_\_\_\_\_

## SCIENCE CONTENT RUBRIC

- Level 4** Response demonstrates a complete understanding of science concepts. It provides additional information beyond what is being asked. It uses relevant science vocabulary. Any supporting drawings are very clear and well labeled.
- Level 3** Response demonstrates a complete understanding of science concepts. It uses relevant science vocabulary. Any supporting drawings are clear and labeled.
- Level 2** Response demonstrates a partial understanding of science concepts. It may be incomplete but it is partially correct. As appropriate, supporting drawings are included.
- Level 1** Response demonstrates a minimal understanding of science concepts, but some attempt was made.
- Level 0** No relevant response.

**We suggest that you do NOT use this following section in routine science notebook writing; many find it stifles participation and growth in problem solving. The Communication Skills is offered as an option to use when the student has been asked to revise and improve the writing in particular assignments.**

## SCIENCE COMMUNICATION SKILLS RUBRIC

- Level 4** Uses well-organized language structures (sentence, paragraph) and conventions (grammar, spelling, punctuation, capitalization) with minimal errors, as appropriate for grade level or IEP. Writing is clear, concise, and neat.
- Level 3** Uses language structures (sentence, paragraph) and conventions (grammar, spelling, punctuation, capitalization) with few errors, as appropriate for grade level or IEP. Writing is clear and concise.
- Level 2** Uses language structures (sentence or paragraph) and conventions (grammar, spelling, punctuation, capitalization) with some errors, as appropriate for grade level or IEP. Writing is generally clear.
- Level 1** Use of language structures and conventions is weak with frequent errors, according to grade level or IEP, and interferes somewhat with communication.
- Level 0** Use of language structures or conventions greatly interferes with communication.

## Appendix B

**Connections with ELA Standards:** There is no one source for these suggestions; they are common to many programs that see value in students becoming skilled as writers and scientists. The features here have been highlighted in workshops offered by LASER and el Centro. The new STC teacher guides provide helpful information.

Also, they reflect ELA standards. The following table highlights the key learning standards from Massachusetts; there are other connections:

<b>Science Notebook Writing and MA ELA Learning Standards</b>	
ELA Standard	Connection between Science NB with the standard
LS 2: Questioning, Listening, and Contributing	The role of questions is emphasized and guides the work.
LS 4: Vocabulary and Concept Development	The glossary contains the introduced terms; the words are added to the glossary as the concepts are developed (not introduced)
LS 19: Writing (informational / expository writing)	All of the writing in science notebooks is either informational or expository; details are expected.
LS 20: Consideration of Audience and Purpose	By sharing notebooks, students become critical of their own work and will strive to improve.
LS 21: Revising	The 'Mini-Marker' system of feedback encourages students to look closely at work and find ways to improve it.
23: Organizing Ideas	The structure is logical and students begin to understand 'where things belong'. This NB entry structure parallels that of a paragraph: Question = introductory sentence Drawings/Labels = middle sentences providing detail Answer = concluding sentence.
24: Research	This entire endeavor is based on first-hand research; students come to learning from books is second-hand research (the author may be sharing his/her first-hand research).
25: Evaluating Writing and Presentations	Feedback is a natural part of science; by engaging in peer review (of NB) frequently, students become comfortable in evaluating work, based on some understanding of what was expected.

