

Five Good Reasons to Use Science Notebooks

Joan Gilbert and Marleen Kotelman

Science notebooks are an everyday part of learning in the Tucson (AZ) Unified School District. Recently, K–8 schools there began using notebooks in conjunction with their kit-based science program. As part of the district’s professional development team, we helped during the implementation at Miller Elementary, where teachers and students undertook this journey together. Now, they can’t imagine learning science without them.

When the call to implement notebooks throughout the district came about two years ago, teachers embarked on a coordinated, schoolwide effort. A study group formed to assess what teachers wanted to achieve through the use, practice, and effectiveness of notebooks as they incorporated them into their science curriculum. Now, we’re ready to share their “noteworthy” discoveries. While there are many reasons to incorporate the use of notebooks into science, these were the most compelling.



1. Notebooks Are Thinking Tools

One of the most important ideas that affected the teachers at Miller was the realization that the notebook was a tool for every student to use to construct his her own conceptual understandings.

Consider this example from a group of first- and second-grade students “meeting” snails for the first time. To begin, students spent about 20 minutes observing the snails as the teacher guided and recorded their thinking on a class chart. The teacher noted questions students asked and prompted students who shared an observation to add a “wondering,” a question that springs from the observation.

The class was highly engaged in the discussion, and soon students were asking to draw and write about the snails in their notebooks. So, for the next 15 minutes or so, students recorded their observations, notes, and drawings in their notebooks as well as any questions they had:

I see it coming out its shell! How far out will its head come?

It has funny things on its head—are those its eyes?

Its shell curls around—do all snails have the same kind of shell?

I wonder if it can see colors or only black and white?”

I wonder what it will eat—the same things as the crayfish or different?”

I wonder how it sleeps—all curled in its shell?”

When their investigation began, the teacher encouraged students to talk about what they saw, but observation lacks direction without attending to the next step—wondering. The notebook enhanced this aspect of the investigation. As students eagerly wrote and drew in their notebooks, the teachers observed they were interacting more deeply with the subject matter. Many students had added their own questions on the topic that had not been

charted by the whole class. As every teacher knows, those students who ask relevant questions about the subject matter often grasp core concepts.

Another indication of more in-depth thinking by the students was the increased use of details in their observational drawings. Many students had previously only sketched the animals (some had even added human characteristics to their drawings), whereas now all student drawings were exhibiting accurate scientific details. The notebook had become a tool for students to establish as well as explain their thinking.

Bottom line: The notebook is a tool that encourages students to use writing for thinking and empowers them to become active in their own learning.

2. Notebooks Guide Teacher Instruction

For teachers, students' notebook writings provide documentation of students' thinking, which can be used to guide instruction in the study. For example, in the snail study discussed above, after reviewing students' notebooks, the teacher observed that almost all of the students had written at least one question relating to what or how snails eat. So, the teacher decided her next step with students would be to plan investigations that explore that topic.

In addition, the inclusion of visuals, such as graphs, charts, tables, and diagrams—a mainstay of many science investigations—in science notebooks taught students that information and ideas can be communicated in different ways and that some methods of communication are better suited for particular information. One example of this was when students began to notice and document in their notebooks that the snails were eating different items and amounts over time. The teachers, as they reviewed their students' notebooks, took advantage of these observations and taught the students how to create a graph that visually represented this data and more clearly demonstrated trends over time.

Bottom line: Notebooks give teachers access into students' thinking—what they do and don't understand, what misconceptions they have, and the organizational skills they are using. Teachers can use “notebook” assessments to guide their next steps in instruction.

3. Notebooks Enhance Literacy Skills

Students have opportunities to use various forms of expository writing—procedural writing, narrative writing, descriptive writing, labeling, and other styles—in their science notebooks. Figure 1 lists examples of the various forms as they might occur in a science notebook.

Figure 1. Develop expository writing through science notebooks.

Students need to practice writing to learn the craft of writing. They need to know the forms of expository writing and what purpose they serve. The examples of student writings below demonstrate the various forms of nonfiction writing that can occur within a science notebook.

Descriptive:

“The long-legged milkweed bug usually moves very fast across the branches that we put in the habitat jar.”

Procedural:

“We plan to give the snail three different types of food to see which one it prefers. First, we will set up a place for the different kinds of food in the habitat. Next, we will put three different kinds of food in the places we prepared. Finally, we’ll observe the snail to see which food it eats.”

Narrative:

“Today the largest male crayfish moved from house A into house B, kicking out a smaller crayfish. There are three crayfish in one pond, and usually they spend more time in the houses. They always come to the middle of the pool when we feed them. And we clean their pond once every week to be sure they have a clean and safe environment.”

Explanatory:

“I learned that the ground erodes more easily without vegetation than with it because the vegetation slows down the water when it rains. When the water flows more slowly there is less force to cause erosion.”

Persuasive:

(often a writing assignment using the notebook for supporting details) “Nylon is not the best fabric for a raincoat because it is too light and the water soaks into it.”

For many teachers, a major benefit of using science notebooks is writing practice for students. Several of the teachers at Miller commented that writing frequently in science notebooks helped students feel more comfortable with the writing process—and that this practice and the skills developed during it transferred to more formal writing assignments, such as book reports or creative writing exercises.

In some cases, teachers observed that students’ ideas were clearer when they communicated through a combination of written and visual text. One of the Miller teachers had their students create a chart to collect the function of various snail body parts. The chart promoted students’ focus and understanding of structure/function:

Structure	Function
Shell	Protection
Foot	Ability to move and climb
Eyes on antennae	See all around, pull in for protection

The school principal, particularly, has been impressed with the language skills being developed through the use of notebooks in science: “When I walk into the classrooms, I see the students talking, talking, talking. They are talking about the science and using academic language. Students’ excitement for learning is bubbling over. Our goal is to tap into this enthusiasm for learning to build oral and written language—notebooks are helping. Our English Language Learners are especially benefiting.”

Bottom line: Notebooks offer numerous opportunities to develop and enhance students’ communication skills, written, visual, and oral.

4. Notebooks Support Differentiated Learning

The use of notebooks can be especially helpful when addressing the needs of students with mixed ability levels in a single classroom.

Even students who may have poor writing skills can use visuals such as observational drawings and graphs/tables/charts to indicate their learning or even any misconceptions

that may arise. The teachers in the study group realized how critical it became for them to provide ongoing feedback to their students, both written and verbal. Those students who were reluctant or less skilled writers often improved their explanations and descriptions when teachers engaged them with individualized feedback, which they often did on sticky notes right on the notebook pages.

This ongoing interaction in the notebooks especially challenged higher-level students as teachers asked them increasingly more involved questions during their study. All in all, teachers commented throughout their study group sessions that they felt they could individualize in a unique way when they provided feedback over time in their students' notebooks.

For English-learning students, some teachers suggested that students draw and write in their notebook in their primary language. For example, a fifth-grade girl coming directly from Mexico can not only participate in the hands-on portion but also draw and write her own questions and describe key learnings in her primary language. As the English language develops, the student can begin using both languages according to her comfort level (keep in mind that the student's notebook is for the student to make sense of his or her own learning). If a teacher does not speak English, another student can possibly translate it with the new student present.

For teachers, the notebook provides the window into all students' thinking, their level of conceptual understanding, vocabulary, and language skills. When teachers have the opportunities to tap into their students' thinking through their notebook entries, they can formatively assess concept development. Students are able to successfully work at their ability level while the teachers are able to question and prompt each individual student's thinking to further his or her learning.

Bottom Line: Notebooks provide a structure and support for all students to achieve.

5. Notebooks Foster Teacher Collaboration

The schoolwide notebook implementation showed teachers at Miller they needed each other—it was imperative for them to support each other's efforts and reflect together on the challenges of using notebooks. In preparation for the implementation, the teachers researched the use of notebooks (see "Favorite Notebook Resources," at the bottom of the page), then conducted study groups to share what they learned. As the implementation progressed, they continued the study groups to monitor the use of notebooks and question and improve practices. Figure 2 lists some tips for successful study groups and suggests appropriate topics for study groups.

Figure 2. Tips for effective notebook use study groups.

Organize groups of teachers with whom to work—either by grade level or within two grade levels. Meet at least every other week to provide plenty of time to process observations during notebook implementation.

Set incremental goals and build a repertoire of skills with your students—and make sure to share quality student notebooks.

Bring student notebooks to each session. Through discussion and reflection, discover how students express scientific thinking through their notebooks. Comparisons across grade levels can also guide lesson planning and instruction.

Study Group Topics

Notebook exemplars

Student self-assessment

Meeting individual students' needs

Expository writing skills from notebooks

Scientific drawing

Writing constructive comments

The collegial process of learning that the Miller teachers went through provided them all with support and a clearer vision and direction for improvement. By viewing one another's notebooks, they were able to build on one another's successes.

Teachers noted several benefits to their practice as they engaged in the study group and learned more effective uses of notebooks. They found that sharing their strategies provided a wider repertoire for each other as they grappled with what worked best for increasing students' understanding of science concepts. As examples of notebook entries were gathered, it became apparent that students have many ways to display their knowledge of subject matter. Conversations among the teachers helped them realize how these different formats provide a picture into students' thinking. Using a book for guidance also gave the teachers permission to try new ideas and extended their knowledge. Both teachers and students came to realize there often is more than one right way to organize and express ideas.

Bottom line: Coordinated efforts and working toward shared, agreed-upon goals are good ways to bring together the school community and show teachers they're valued.

Joan Gilbert (joan.gilbert@tusd1.org) is principal of Peter Howell Elementary School in the Tucson Unified School District (TUSD). At the time of the study groups, she was a collaborative teacher with the D.E.S.E.R.T. (Districtwide Emphasis on Science Education Reform in Tucson) Project, working with several schools in TUSD in science professional development.

Marleen Kotelman (marleen.kotelman@tusd1.org) is the elementary science coordinator for TUSD in Tucson, Arizona.

Resources:

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.

Connecting to the Standards

This article addresses the following *National Science Education Standards* (NRC 1996):

Teaching Standards Standard B:

Teachers of science guide and facilitate learning.

Standard C:

Teachers of science engage in ongoing assessment of their teaching and of student learning.

Favorite Notebook Resources

Teachers throughout our district have found these resources valuable while implementing notebook use into their classrooms.

I See What You Mean

by Steve Moline

1995. Portland, ME: Stenhouse.

This book provides many ideas in developing visual literacy, including graphs, tables, charts, and graphic organizers. Our teachers found it provided clear guidelines for teaching and using a variety of graphics to enhance communication and learning.



Is That a Fact? Teaching Nonfiction Writing K-3

by Tony Stead

2002. Portland, ME: Stenhouse.

This book offers insights into how science notebooks support the nonfiction writing genres, providing extensive lists of writing opportunities depending on the writers' purpose. Comprehensive rubrics for descriptive, explanatory, procedural, and persuasive writing provide wonderful guidance for skill development.

Reading and Writing Nonfiction Genres

by Kathleen Buss and Lee Karnowski

2002. Newark, DE: International Reading Association.

The TUSD Science Department uses this book in professional development with teachers on the benefits of science notebooks in developing writing skills in the genres of nonfiction—recount, procedural, informational, and persuasive.



Science Notebooks: Writing About Inquiry

by Brian Campbell and Lori Fulton

2003. Portsmouth, NH: Heinemann.

The Miller teachers used this easy-to-follow guide with its organizing and engaging questions to lead them on the quest to improve student understanding in science. In TUSD, several other groups have also used this book, which is written for teachers at all levels of notebook use. This book is a must for any study group on notebooks.



Tucson Unified School District Science Resource Center

<http://instech.tusd.k12.az.us/Science/src.html>

This website's "Using Science Notebooks" has a lot of information and data about the value of science notebooks. While the website was created in support of the Arizona state science standards, which now require the use of student notebooks in science, much of the information would still be of interest/use to teachers elsewhere interested in exploring this topic.