Success for All: A Story of Inquiry Science and a Student with Special Needs

by Deb Schochet

Hannah began third grade in my classroom with reading and writing skills that were at a kindergarten level. She was new to my school and had an Individual Education Plan (I.E.P.) in all academic areas. Rather than being placed in the self-contained special education classroom, she joined my students in a general-education classroom because her social skills were so well developed. When I met Hannah at the beginning of the school year, her mother told me that her daughter had always had negative feelings about school. Yet, during the less than five months she has been in my classroom so far, Hannah has demonstrated tremendous growth in her abilities, confidence, and view of herself as a learner. I believe her growth is due largely to the inquiry-based approach to teaching science and the scaffolded approach to teaching science writing that is explained in this book.

Hannah is not alone. All my students, regardless of their academic skills, benefit from participating in rigorous and challenging science investigations and then writing in their science notebooks. Their personal experiences in the rich context of science are extremely meaningful to them, and the enthusiasm and excitement I see during their investigations and discussions are not displayed to this degree in other academic areas.

Through shared experiences and careful scaffolding, my students are able to master difficult science concepts and communicate about them. During each science lesson, students work with concrete materials as they explore a focus question and gradually construct their understanding of science concepts. At the same time, they develop their abilities to act and think like scientists. Students also participate actively in reflective discussions after each investigation, which enables them to recognize their misconceptions and deepen their conceptual understanding through conversation and eventually writing. The discussion especially benefits students like Hannah because during discussions and questioning, I model, and then students begin to use, appropriate scientific language. Students practice the language orally with partners during both the investigations and reflective discussions, before they begin writing entries in their science notebooks. Saying what they want to write just before writing the first sentence in their notebook, for example, helps all the students get going with their writing.

Having seen so many students with very different academic abilities experience such success in science and science writing, I always am surprised when I hear other teachers say that they worry that so much writing is going to diminish their students' enthusiasm about science. Over the years, I have observed the opposite effect. Writing about science actually increases the students' enthusiasm because they internalize the belief that their observations, data, and scientific thinking are important enough to share with a larger audience through writing. Furthermore, I have noticed that when students build skills through science writing, they transfer these skills to other genres of expository writing (for example, they routinely use *because* to provide reasoning in all subject areas). Having these skills will continue to serve them well as adults.

Hannah's Progress

Hannah has achieved a high degree of success with inquiry-based science because the entire class experiences all the components of this type of learning together. They begin each science session with concrete materials, which means that all the students are starting at the same place regardless of their prior knowledge, their native language, or their reading and writing abilities. For Hannah, this has been one of the rare times in school during which she has felt as skilled and successful as everyone else. Ironically, when students with special needs like Hannah are pulled out of the classroom for extra support, science is often the first thing to be cut from their day. I think this is unfortunate because in my experience, science tends to be the area in which these students can have the greatest degree of success because they have equal access to the learning.

Another factor that contributes to student success in this approach is that the students feel a tremendous sense of pride because they see themselves as scientists and know that their work is important. Hannah demonstrates an amazing sense of accomplishment whenever she completes a challenging task. For example, in her science notebook during one session, she was to make a scientific illustration of a bee, showing it as a system with its parts and their functions labeled. When she finished the illustration, she told me—standing tall, eyes shining, with a wide smile—"Look what I did!" She realized something on her own about her abilities as a scientist and as a student. It was her turning point because she suddenly began to see herself as capable of succeeding at difficult academic tasks. It was the first time, as far as her mother and I could tell, that Hannah truly was seeing herself as a student and a learner.

Seeing the growth in Hannah's notebook entries over the first months of third grade exemplifies the positive effects that science can have on a student who has never experienced success in school. Hannah wrote the entry shown in Figure 1 in her science notebook during the second week of third grade, right after the second lesson of the *Plant Growth and Development* unit published by Science and Technology for Children (STC).

During the lesson, the students observed a dry bean seed, placed it in water overnight, and then observed changes in the seed (now known as the "soaked bean") after it had been soaking. Hannah's sample shows a box and T-chart. I was teaching this strategy to my class for the first time, so I modeled the process, using the data recorded in the data table in my science notebook, and the class helped me make decisions about where the data were the same and where they were different. In order to give all students practice with reading data and making these decisions, they discussed my data with their science partners first. By doing so, every student was fully prepared to contribute ideas to the whole-class conversation. After this conversation, students used the data from their own notebook to create their own box and T-chart.

Hannah's box and T-chart have important strengths, which I shared with her during one of our short conferences. She finds one similarity, the shape (circle), and lists it in the box of the organizer. She also lists a few differences in the color (light green versus green) and texture (soft, dented versus wet). The entry also demonstrates that when she conducted the investigation, she was able to collect and record observations in a way that enabled her to refer back to them later.

Although Hannah's entry also shows weaknesses, I chose not to address those with her because she had no confidence in her academic abilities. At that point, for example, she was unable to take the information from her box and T-chart and form it into sentences.

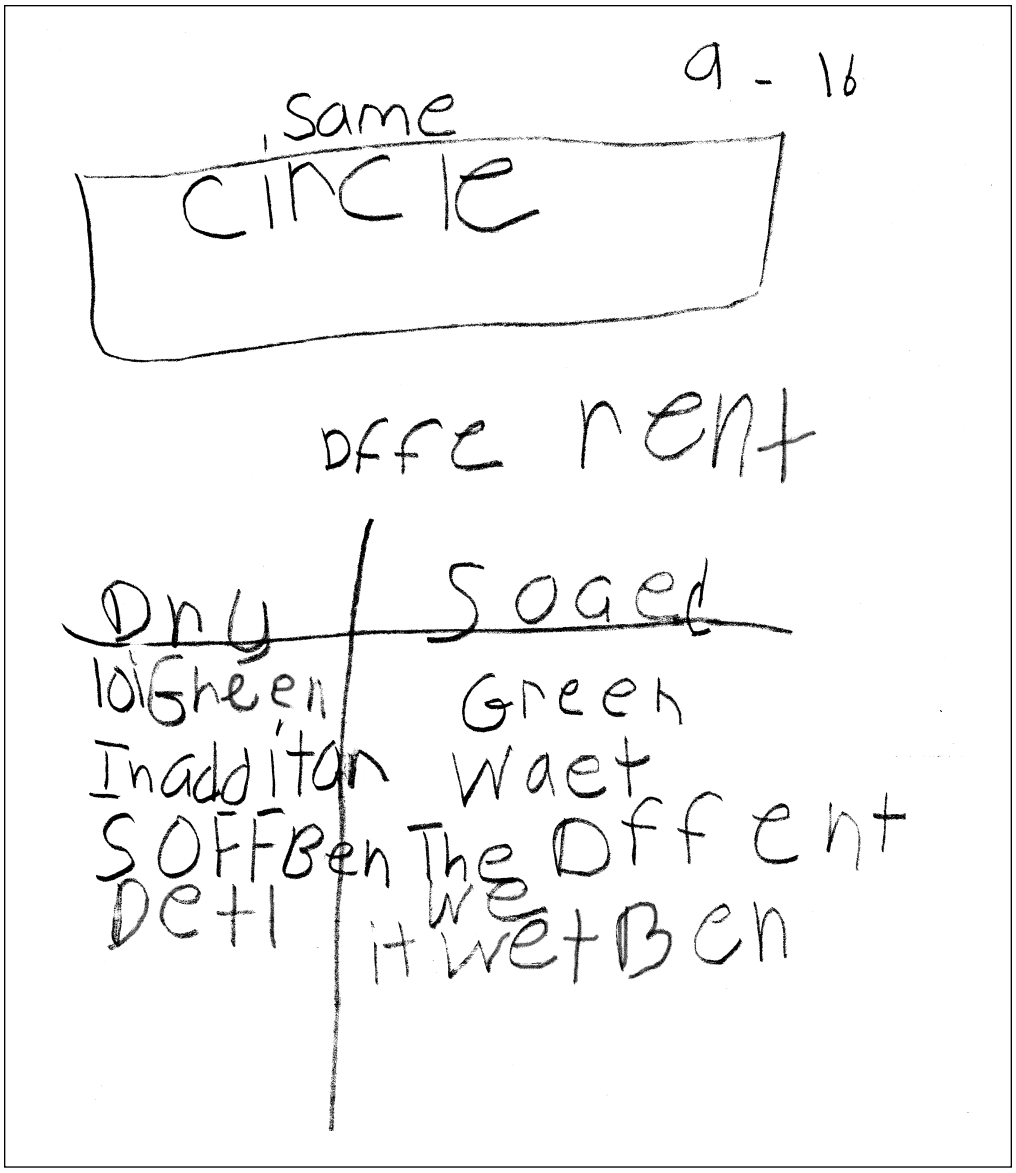


FIGURE 1 ***Hannah's entry at beginning of the school year***

But she had long been well aware that she had academic weaknesses, and that was not an awareness that was going to motivate her to move forward in her scientific thinking, understanding, and writing. Rather than discussing those weaknesses with her, I first needed to help her realize her academic strengths.

With all students, my feedback about their notebook entries, which are considered rough drafts, always focuses on the *content* and *thinking* in their science writing: "Does the entry make sense when you reread it? Do the organization and words make it clear to another scientist what you are trying to communicate?" The initial focus on content, organization, and word choice is entirely appropriate in the writing process, especially in scientific writing. This emphasis also frees up students who typically struggle with conventions in particular, but who can do well with other writing traits that involve content, organization, and word choice.

Hannah's next sample (Figure 2) is from less than five months later during our second third-grade unit, *Rocks and Minerals* (published by STC). Her box and T-chart organizer shows that she has made tremendous growth. She lists the following properties that minerals G and E have in common: shiny, rough, multicolored. Then she classifies in her T-chart the differences in their properties (the "vs." represents the vertical line down the middle of each row in the T-chart): "jgide [jagged] vs. shooth ejis [smooth edges], sivren [silver] vs. green and white, flace [flaky] vs. not flace [flaky], lare [layer] vs. not lare [layer]." Her observations are more detailed, her organizer includes only listed observations, she is consistent and organized in the way that she compares differences in properties across from each other, and she uses scientific terms that are detailed and precise.

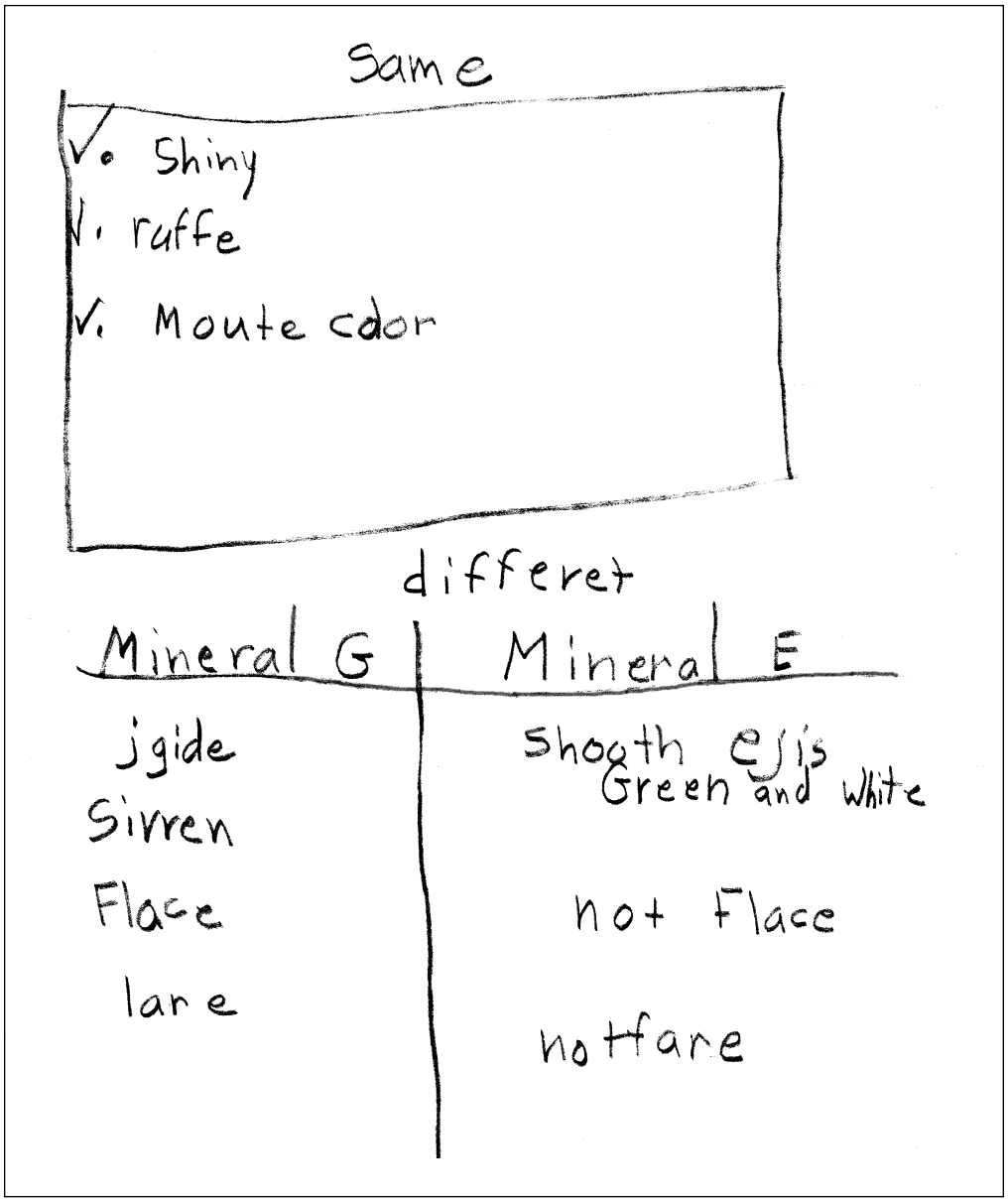
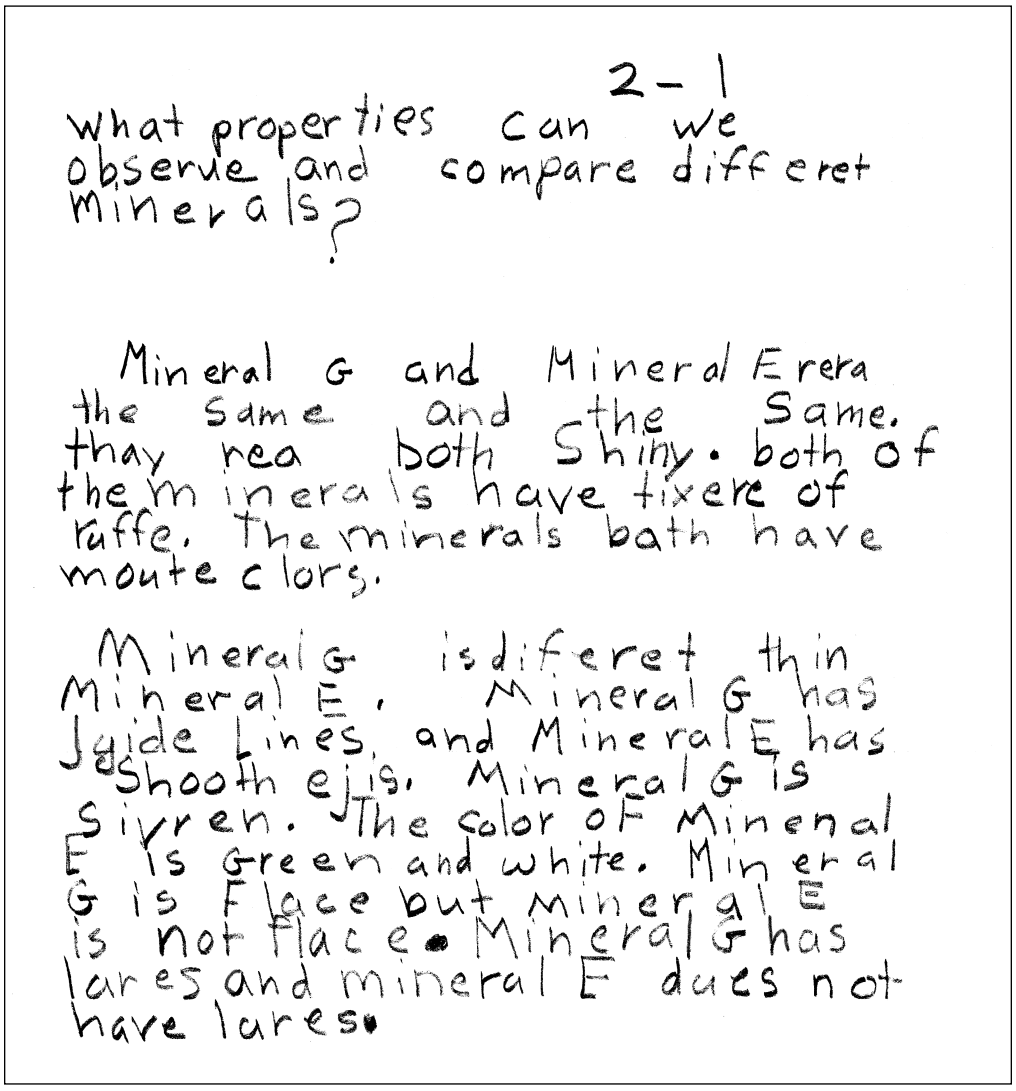


FIGURE 2 ***Hannah's entry five months later***

In September, Hannah could not write a comparison. But less than five months later, she writes the entry shown in Figure 3 using the information from her organizer. The second paragraph is particularly complex: "Mineral G is diferet thin [different than] Mineral E. Mineral G has jgide [jagged] Lines and Mineral E has Shooth ejis [smooth edges]. Mineral G is sivren [silver]. The color of Mineral E is green and white. Mineral G is Flace [flaky] but Mineral E is not flace [flaky]. Mineral G has lares [layers] and Mineral E dues [does] not have lares [layers]." Hannah not only has organized multiple properties into two sections, one for similarities and one for differences, but she also is able to write full sentences about each property of the minerals in her box and T-chart.

Hannah's writing abilities have grown because of consistent modeling, support, and scaffolding. I have provided her with a range of strategies and tools, and she has become increasingly independent in selecting appropriate strategies to use. At first, she needed to use my notebook, with a blank box and T-chart, right next to her notebook to copy the formatting correctly. Later, as her skills increased, she began to rely on charts in the classroom


2-1

What properties can we observe and compare differet Minerals?

Mineral G and Mineral E rera the same and the Same. thay rea both Shiny. both of the minerals have tixere of ruffe. The minerals bath have moute clors.

Mineral G is diferet thin Mineral E. Mineral G has Jgide Lines, and Mineral E has Shooth ejis. Mineral G is Sivren. The color of Mineral E is Green and white. Mineral G is Flace but Mineral E is not flace. Mineral G has lares and mineral E dues not have lares.

FIGURE 3 ***Hannah's entry continued***

for support. She had access to word banks with scientific terms posted in our science area and lists of transition words and phrases. She used writing frames and sentence starters. Most important, I continually modeled using all these supports. In addition, our class wrote compare-and-contrast entries together. Pairs of students discussed each sentence of the entry before I asked for suggestions from one or two people. I modeled how to check off items in the organizer as we included them in the writing. This modeling and scaffolding allowed Hannah and other students to work quite independently, although I always checked in with them to provide extra support.

Largely due to inquiry-based science and this science-writing approach, Hannah's confidence and academic abilities have grown remarkably during these early months of third grade. In a relatively short period of time, she has come to believe in herself as a learner. School is a place of joy for her now because of her daily experiences as a capable and successful student. She loves to show off her work to other adults in the school because she is tremendously proud of and enthusiastic about her accomplishments.

One day, after less than five months of an increasingly successful academic year, Hannah announced to me that she wants to be a science teacher when she grows up. Transformations like this are what motivate me to ensure that all my students get to engage in scientific inquiry and science writing almost every day they are with me. I feel such a sense of satisfaction when I think of future students who will get to learn from a science teacher like Hannah.