

Let's Take Another Look At the Fish: The Writing Process as Discovery

by

BOB TIERNEY



Probably every science teacher has heard the tale of Louis Agassiz and the fish, but few have heeded its significance. It's a meaningful message, applicable for teachers across the curriculum.

Louis Agassiz was a Swiss-American, 19th-century naturalist who proved there was once an Ice Age. Although famous for his work regarding glaciers, he was invited to the United States based upon his writings about fossil fish. He spent the last part of the century as a professor at Harvard; the Museum of Comparative Zoology at Harvard is named for him.

One of his students wrote an essay, "A Pencil is One of the Best Eyes" (In Sparke & McKowen, 1970), about learning under the famous professor. Agassiz began one lesson by asking the student what he wanted to learn and how he intended to use the knowledge afterwards. He then told the student to carefully remove a preserved fish from a jar and observe it. "I will ask you later what you have learned," Professor Agassiz told the student.

The student gazed at the preserved fish. In ten minutes, the student had seen all that he thought might be seen of the fish. He looked, in vain, for his professor. Not finding him, he was forced to spend another half-hour looking at the loathsome pickled fish. He then went to lunch. When he returned the fish was still in the pan, and the professor could not be found. Bored and thoroughly sick of the smelly fish, the student pulled out a pencil and began to draw the fish. He discovered several new features of the fish. Finally, the professor returned. The student showed Professor Agassiz the drawings.

"That is right," Professor Agassiz said. "A pencil is one of the best eyes. Well, what is it like?"

Professor Agassiz listened attentively to the student's explanation of what he had learned, but to the student's dismay he said, "You have not looked very carefully, Why? You have not even seen one of the most conspicuous features of the animal, which is as plainly before your eyes as the fish itself; look again, look again!"

Resentfully, the student observed the fish again, but went about the task with a renewed vigor. He discovered one thing after another, realizing how just the professor's criticism was.

"Do you see it yet?" the professor asked.

"No," replied the student. "I am certain I do not, but I see how little I saw before."

"That is the next best," Professor Agassiz answered. "I will not listen to you now; put away the fish and go home; perhaps you will be ready with a better response in the morning. I will examine you before you look at the fish again."

So the student left the classroom without his notes or the specimen, but required to search for the most visible feature the professor alluded to. He strolled along the banks of the Charles River, his mind focused on the fish and what he would explain to the professor. The next morning, the professor greeted him cordially and seemed as anxious as the student that learning had taken place.

"Do you perhaps mean," the student asked, "that the fish has symmetrical sides with paired organs?"

"Of course, of course," replied the professor, obviously pleased, and he proceeded to talk for several minutes about the importance of what was discovered.

The student then asked, "What should I do next?"

"Oh, look at the fish!" Professor Agassiz said, and left the room.

An hour later Professor Agassiz returned and listened eagerly to any new discoveries the student made. "That is good, that is good!" Professor Agassiz repeated as the student explained, "but that is not all; go on, look at the fish." For three days the student was forced to look at the fish without the use any artificial aid. "Look, look, look," admonished Professor Agassiz when the student asked questions.

On the fourth day, Professor Agassiz brought in a second fish of the same family and placed it alongside the first. The student was asked to point out the differences and similarities between the two. Another fish, and another were laid out until the entire family was before the student and the student understood the relationships between the fish.

"Facts are stupid things," Professor Agassiz said, "until brought into connection with some general law."

This story haunted me during most of my early career as a science teacher, resulting in a sense of guilt about my own teaching efforts. I realized I was a presenter of facts, wondering why the students never seemed to understand the concepts. I tested for knowledge of facts, knowledge the students retained just long enough to pass the multiple-choice examinations. It was education by checklist.

I had been a presenter of information when I needed to be a facilitator of learning. I had lots of facts, and if I ran out, I could always look up more. Later in my teaching career, after my exposure to the writing project, I realized the writing process is a discovery technique that can get students personally and emotionally involved, a way of getting them to look once

again at the fish. It is a means of accomplishing what Louis Agassiz had succeeded in doing with his students. I began devising writing assignments designed not so much to inform, but to help students understand. I wanted my teaching to be more like Agassiz's and less like the questions at the end of the chapter.

On one occasion, my students entered to find a leaf had been placed on each desk. "I want each of you to observe your leaf," I said. "But I want you to conduct this observation following my instructions."

I asked them to divide a piece of paper into four quadrants and number them one through four. "Now in square one, write a description of the leaf." When they read aloud their descriptions I was encouraged by the variety of their perspectives.

Some focused on the facts before their eyes: "The leaf is green." "The leaf has veins."

Some put other senses to work: "The leaf smells like camphor."

One relied on a basic tool of science, the ruler: "My leaf is two and a half inches long."

Another student made a comparison: "It looks like the teeth of a saw."

I next asked students to use square two to finish the following sentence: "This leaf is like _____ because...." They decided that the leaf was:

a road map because the veins appear to be highways;

a canoe because of its shape and the fact that it floats;

the dress I bought for the prom because it is shiny green on the outside and dull green on the inside.

After writing these metaphors on the board, I asked, "Which of these represents the most far-out way of thinking about a leaf?"

The students were now at the center of the discussion, and I, like Agassiz, was taking a risk, unsure of what the students would come up with.

I remember on another occasion asking a writing project group at UC Berkeley to create a leaf meta-

phor. The leaf, observed one writer, is like a “be-draggled, just neutered dog: torn, wet, with a surface full of mold.” We had a lot of fun with that one.

Back in the classroom, I asked students what it would be like to be whatever it was they chose as the most far out metaphor. They were to imagine that life in quadrant three. As a group we agreed that the prom-dress metaphor was pretty far out. Here are some of the ways students brought the dress to life. The leaf connection was not lost on the students.

By the end of the dance I am bathed in sweat.

When the girl moves, I move.

I am making the girl more attractive, more noticed.

When I am exposed in just the right combination of light and shadow my texture and color can be extraordinarily beautiful.

Finally, I asked the students to use the fourth quadrant to again comment on the leaf. All along they had listened to each other. This sharing was reflected in their responses. Now, also, they were asking questions about their observations.

Why is one side of the leaf darker than the other side?

How does the leaf breathe?

Does a leaf, like a prom dress, need to be cleaned? Is God the great leaf cleaner?

I then ask the students to write one sentence about something they believe to be true about the leaf, thus beginning a search for the truth which will become the motto of the class. Then comes the inevitable question: What do we mean by true? We define truth as something that cannot be argued with. Sentences are scrutinized to see if they can be disputed and, if so, they are rewritten so that they are irrefutable.

For example, a student might write, “Leaves are green.” After a discussion the sentence might be altered to read, “Most leaves are green, but some can be red, yellow, or purple.” A biology student might write, “The stomata controls the amount of air entering the leaf.” After discussion, often a lively one, the sentence might be revised to read, “The opening of the stomata,

under osmotic pressure, can regulate the amount of carbon dioxide the leaf gets.” The students learn to differentiate between fact and assumption. This exercise pushes students toward specific thinking. Students will not write in a more specific way until they learn to think in more specific ways.

This exercise generates lots of questions about the object. Why do leaves turn color? Why isn’t the underside glossy like the top? Are the veins of the leaf like the veins in our body? I build my upcoming lecture around these questions, giving the students some of the ownership of the presentation. If they accept ownership, they must also accept the responsibility for learning, just as Louis Agassiz put that responsibility on his student. Agassiz didn’t give the student facts. He facilitated the student’s understanding.

Students had been forced to think about the leaf, looking at it from different perspectives. I was showing, not telling students more complicated ways of writing about the leaf.

Since this first adaptation of Agassiz, I have varied and expanded this activity, using a variety of objects, sometimes even fish.

I try to emulate Agassiz in other ways. Agassiz placed other fish alongside the fish his student was observing. Applying the Agassiz aphorism, “A pencil is sometimes the best eye,” I frequently start a unit about the human eye by having students draw each others’ eyes. Forced to observe closely, students notice similarities and differences that help them draw conclusions just as Agassiz’s student did when asked to compare fish.

Just as Agassiz had his student think about the fish without his notes or the specimen, I often have my students do what I call a Neuron Note. The name is biological, it is jazzy, and it implies thinking. The students go home without their books or notes and write a summary of what they think they understand. I stress to the students that it is all right if they do not understand, but they need to realize they don’t understand. Just as Agassiz’s student said, “I see how little I saw before,” the Neuron Notes help students identify what they do not yet understand. I give students full credit if they write their Neuron Note, none if they don’t. The following is typical of a Neuron Note by a general science student trying to express his comprehension of osmosis:

Osmosis is to do with water and cells. Osmosis is the absorbing of water by cells, or pass through. I don't know what it does exactly once it's inside. Osmosis is not the only way, but the one that is used the most is diffusion. I would like to know where they got a name like osmosis for it? Osmosis is different than any other form, but still gets the job done. When it occurs water actually passes through a somewhat membrane so as to equalize the amount on both sides of the cell or whatever kind of membrane it is.

The lesson provides an insight as to what the students really understand. I can determine if they are really ready for a test. In the old days I decided the test date months ahead, usually on a Friday, and gave the test regardless if the students were ready. I also complained, along with my colleagues, about how many students did not study.

In responding to the Neuron Notes, I try to emulate the one-on-one relationships Agassiz had with his student in the fish story. My students, at the beginning of the school year, provide me with a blank audiotape. I believe that the best response to student writing is the oral response, not the written reply. I put the tapes into bags, by period, and when they turn in a Neuron Note, I reach into a bag, find the tape, and then find the student's paper. As I read the paper, I talk to the student. I am able to coach each student, one on one, for the upcoming test. I congratulate the students on what they understand. I do not provide answers. Like Louis Agassiz, I ask questions that allow the student the exhilaration of their own discovery.

I later came to know some things about short-term and long-term memory and realized Louis Agassiz's teaching technique succeeded in imprinting his student's understanding into the long-term memory. Those early lessons of mine only ended up in the short-term memory of a student. Using the analogy of the computer, these lessons might have made it into their RAM, random access memory, but they were not getting into their hard drive. One way to place concepts of a lesson into the long-term memory of a student is to have the student associate the lesson with what she already knows. Another is to get the student emotionally involved. These writing exercises use both of these methods.

Some teachers, pressured to prepare students for tests that rely heavily on factual regurgitation, are struggling for a way for their students to assemble facts into a comprehensible concept. When I ask myself how Louis Agassiz might meet this contemporary challenge, I can almost hear his ghost whispering in my ear, "Look, look, look again at the fish."

Reference:

Sparke, W. & McKowen, C. (1970). *Montage: Investigations in language*. New York: Macmillan.

Bob Tierney is a TC with the Bay Area Writing Project. Now retired, he is mayor of Poker Flat, CA.