How Enzymes Act:
Skit Writing in Science Class
By John Dorroh

Ten years ago enzymes that talk would not have been part of my biology curriculum. But that was before the National Writing Project came my way. The Project, through the Mississippi Writing/Thinking Institute, helped me create a classroom that revolved not around me, as in the past, but around my students. Before NWP came into my life, there were no class logs, no student-created metaphors and analogies, no allowance for students to write their own set of classroom expectations. I was a lecture-oriented science teacher, not the learner-researcher in my own classroom that I am today.

The other catalyst that inspired me to allow performing enzymes in my class was the Mississippi State Science Framework for Biology II. The Framework requires that students learn to "recognize the importance of enzymes—what they are, what they do, etc." Since our textbook did not include an overabundance of information about enzymes, I had to devise an alternative plan for students to learn this material, and out of this process evolved acting enzymes.

I began our enzyme-discovery journey by taking my students to the library to conduct independent research. Here — in science-based journals, on CDROM, and on videos — they found current information that went far beyond any textbook.

The next day I asked students to prepare Fact Sheets, each with a minimum of five facts about enzymes, facts that had not been presented in the textbook. Some of the facts were useful but unsurprising:

Enzymes have many jobs: regulating cellular functions, conducting nerve impulses, clotting the blood, contraction of muscle tissue, and photosynthesis.

Others *were* surprising:

In the honeybee enzymes in the stomach mix and change nectar into honey.

And a few were pretty close to cutting edge:

HIV protease is an enzyme produced by the HIV virus.

How could we now get these pieces of research into a context where they could be shared by the class? I decided to ask students to tape their fact sheets to a sheet of large green chart paper. The sheets were numbered and spaced about two inches from one another, giving the appearance of a quilt. Each class had its own quilt.

Next, we had a silent walk around as students collected "clusters" of facts that seemed to be about the same topic — unusual uses of enzymes, chemistry of enzymes, human health and enzymes, and many other groupings. Of course, some students, unclear on the concept, dove in with complete abandon, collecting a hodgepodge of facts with no apparent relation to one

another. For the most part, however, all had gone well. Students had researched, shared and organized information about enzymes. But what now? I wasn't sure. Fortunately it was Friday so I had two days to figure out a way to pull all this together.

On Saturday afternoon I attended my monthly writers' group. As we generally do, we began by explaining what's been going on in our lives since the last meeting, and school teachers naturally pour out stories about classroom activities.

"We're doing the neatest thing in one of my English classes," Annie, a language arts teacher, began. "I'm having the students rewrite parts of 'Romeo and Juliet' in their own language, using situations that are meaningful to them in their everyday lives." She went on to tell us the particulars, and as she did, my mind raced ahead.

Skits, I thought. *We can write skits as our closing activity!* I had dabbled with skit-writing before in the classroom but the finished products always seemed to lack substance. This time we *already* had substance — all of those wonderful facts, taped to big green sheets which were spending the weekend on the walls of Room 202.

On Monday I told my Biology II students that we were going to write skits, using the fact sheets for our source of material. I distributed old copies of play books to pairs of students, pointing out the various components of the structure of a play: colons after each speaking character's name, skipped lines between speakers, parenthesis to indicate stage directions.

A few students were reluctant to begin the activity, reminding me that this was *not* an English class. "What are you trying to do?" asked Nikki. I stopped to think. What *was* I trying to do? Was writing skits and plays going to advance my students to a new level of thinking about the content? Would it help them *truly* understand enzymes? And, the big question, what does it mean to "truly understand?"

"Nikki," I said, "I have an idea that having you to write skits about enzymes is going to help you focus on the content more than if I were just telling you about them."

Had my brief nutshell explanation satisfied her? Her expression told me that she might be halfway there. I continued. "Do you remember that poster on the bulletin board in the lab, the one next to the refrigerator?"

"No, I don't know which one you're talking about," she admitted.

So we walked into the lab to examine the poster with its red letters against a plain white background. An ancient Chinese proverb was inscribed on it: "Tell me, I forget; show me, I remember; involve me, I understand." We both read the words aloud a few times and I asked her what she thought.

She smiled. "Oh, it's good," she said. "And you know what?" she asked. "It just might work, writing these skits about science stuff."

So it wasn't long before all of my science students were engaged in skit writing: pulling in material from their fact sheets, adding additional facts from other classes' sheets, wondering out loud why their textbook had not included more information. I heard lots, of conversation about enzymes, arguments being artfully delivered, questions being asked, things such as, "Well, which is the more important molecule, DNA or an enzyme?" "Where did the first enzyme come from?" and "Why haven't I heard about them before?" The completed skits entertained us all, and more importantly demonstrated that students had processed what they had learned about enzymes (click here to see example).

My success with acting enzymes prompted another skit-writing experiment. The following year I set out to jazz up my introduction-to-the-class activities. All of us know how beginning-of-the-year textbook introduction is usually done: the teacher issues the textbooks and then tells the students to turn to the Table of Contents. Typically I would then launch into a monologue that went something like this:

"Class, turn to the Table of Contents. (I wait while the students find the correct place.) This year we will go straight into Chapter One, where we will study all about the Scientific Method and famous scientists of the past. In Chapter Two we will begin our study of the cell. In this chapter we will do two labs and answer the questions at the end of the chapter. This book is really good because the questions really make you think ... blah, blah, blah..."

Although I do not consider our textbook the ultimate source of content for my classroom (as my enzyme unit demonstrates), I think it's got many terrific features that my students should be aware of. It's crammed full of hands-on activities and problem-solving situations for cooperative learning. By calling students' attention to the features of the text, I hoped to excite them about the content of the course and help them strategically use the book as a resource. But I knew that my monologue was not the most effective way to achieve these results —I needed to involve the students.

With these thoughts in mind I asked my students, in pairs, to take their textbook and turn to any chapter. "Go through that chapter and make a list of as many components of the text as you can," I said. "We'll define a component as anything that would help you to learn or me to teach." And then I wrote a few examples on the board to make sure that they understood what a component is: colorful pictures with captions, Chapter Preview, Concept Review and MiniLabs.

Most pairs of students easily compiled 15-25 components. Some identified as many as 40.

When the students had compiled a minimum of about 15 components, I offered the following scenario: "One of you is a textbook salesperson from Company X and it is your job to sell the textbook to the Head of the Science Department at your school, or to the principal, or to some other individual who is in charge of making decisions about the purchase of textbooks. The salesperson needs to call attention to the components that you and your partner have written as selling points for the book."

I reminded them that almost all of us have probably had experiences with sales people. “Think about how a salesperson might convince you to buy a new pair of shoes for basketball, or a certain dress. What selling points about their product did they use?”

I also threw in some questions for consideration that dealt with the personal interchange between the salesperson and the students in their past experiences: “Was the salesperson nice to you? Did he or she pressure you too much? Were you an easy sell, or did you put up some resistance? Incorporate some of these items into your skit,” I urged. Once again, I was delighted with the results (click here to see example).

I have discovered that this skit-writing activity has several advantages. First, students have the opportunity to discover for themselves the architecture of our textbook. Second, they are working in pairs, immediately laying the groundwork for more extensive cooperative learning, including the formation of compatible lab groups. Third, I am engaging my students in an activity that lets me begin to assess their writing skills, and consequently their reasoning ability. Fourth, I give students yet another opportunity to see how science and language arts are interconnected.

I’ve incorporated skit writing in other parts of the curriculum as one method of getting students to reflect on content. We collect and file these skits for possible inclusion in a portfolio as documentation that the students are operating at a very high level of thinking.
Yes, lam happy about the way that students discover for themselves about enzymes and other equally fascinating science topics. And whenever I have mild and occasional doubts about the usefulness of this activity, I recall the image of Nikki reflecting in front of the Chinese proverb poster in the lab, and I can hear her say, “It just might work, writing skits about this science stuff.”

Author’s note: I want to thank my friend and mentor, Bay Area Writing Project teacher-consultant Bob Tierney, who showed me one way toward a student-centered science classroom, heavy on writing.

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SAMPLE SKIT 1

Here is a sample skit by Marlisia and Trenorris, slightly abridged.

An enzyme, Trenorris Hammond, is trying to break up the substance, Marlisia.

Enzyme Trenorris: Listen up substance! I am your worst enemy and I am determined to break you up!

Substance Marlisia: And how do you expect to do that?

Enzyme Trenorris: Well if you don't know, I am maltase the enzyme that acts on you, maltose, the substance.

Substance Marlisia: Why, what did I do? And who do you think you are?

Enzyme Trenorris: Well, like I said, I am maltase, and you are maltose. We don't fit together. Therefore, I'll have to break you up whether you like it or not.

Substance Marlisia: Well, if I don't fit with you, why don't you just go away and leave me alone?

Enzyme Trenorris: Because you are slightly bent. This allows an easier break between your bonds and there is nothing you can do about it.

Substance Marlisia: Well, if there is nothing I can do about it, then tell me this, is that good or bad for me?

Enzyme Trenorris: Well it's bad news for you, but it's good news for the body we're both in.

Substance Marlisia: Are you sure there's nothing I can do about it?

Enzyme Trenorris: No, because when the bonds between the parts of the maltose molecules break, the two glucose mo1ecuIes~are released, leaving the active site of the enzyme ready to attack the molecule.

Substance Marlisa: Well, go ahead then, do what you have to do.

SAMPLE SKIT 2

Mrs. Garglemyer. I really don't have time to meet with you, so make it quick!

Mrs. Debmgle: I'm sorry I have to take any of your time, but your time will be well spent if you will listen to me.

Mrs. G.: Well, make it snappy!

Mrs. D.: If I could direct your attention to page 150, the BioLab. You will notice the easy procedure and common materials the students can bring from home!

Mrs. C.: Well the old books from 1960 have BioLabs. I'm looking for something different and more realistic;

Mrs. D.: No problem, I've got your answer. The Broad View section on page 136 helps students see how Biology works in the real world. Also notice Biology and Society on page 153 which gives you applications for the future. Our books also have informative diagrams which help visual learners pick up concepts.

Mrs. G.: Hmmm, that's nice. Are my students going to injure themselves in any – as you call them, "realistic" – labs? –

Mrs. D.: Why, of course not. Every lab has caution hints for the students to be aware of. The textbook also encourages teachers to take other safety precautions.

Mrs. C.: Yea, yea … Everything sounds good, but the students are just performing experiments and writing lab reports.! don't see where the thinking process is coming into the picture. You know, Mrs. Debingle, we have to exercise our minds!

Mrs. D.: Yes, I realize that. Fortunately, our book has Thinking Labs like the one on page 145 which allow students to use the definitions and concepts they have learned to figure out experiments...."

Mrs. C.: You are beginning to convince me. Tell me more, and make it fast.

Mrs. D.: Well, the book has boldfaced words which draw your attention to what is important. Also, the words at the bottom identify the chapter and section.

Mrs. G.: Don't most all books have that?

Mrs. D.: Yes, but not like ours. Our book gives helpful hints on what you can do to save the earth.

Mrs. C.: Well, that's enough for me, Mrs. Debingle. Put in an order for my textbooks, and be on with your day.

Mrs. D.: I promise Mrs. C., you won't be sorry.