Teaching Science to High School Students Who Have Limited Formal Schooling

Kathy Hermann
Annandale High School
Fairfax County (VA) Public Schools
Submitted June 2002

Background

For the last few years, I have been working with ESOL students who have had limited or interrupted schooling in their home country. This year most of my students come from Somalia, El Salvador, or Pakistan. Often these students have had to deal with the effects of war, poverty, and social upheaval. One of my previous Somali students, for example, was a seventeen year old girl who had never attended school before coming to Annandale High School. She had spent most of her life in a small village in Somalia, helping her grandmother tend the garden and the animals. She experienced culture shock as she dealt with crowded hallways, changing classes, and the expectations of seven different teachers. She experienced frequent headaches and stomach aches during her first year at our school. Others of my Somali students left Somalia in the early 1990’s because of the violence in their country and went to nearby countries such as Kenya or Yemen. Usually they were not able to attend school in those countries, though many attended religious classes that were held in Arabic.

Most of my Salvadoran students had attended at least a few years of school in their country, but often they reported that their attendance was sporadic. Even when they did go to school, they experienced very crowded conditions and a short school day so that morning and afternoon groups of students could use the same facilities.

Focus

During the school year 2001-2002, I taught a class called Concepts Science to these students. The purpose of the class was to introduce them to science vocabulary and concepts so that they would be prepared for a high school Biology. Some of my students would need to take this class for more than one year before going to regular Biology.

Prior to teaching this class, I had observed some problems that literacy students had had in studying science. Some of the problems were:

- Difficulty with expected school behaviors, routines, and procedures
- Lack of basic science and English vocabulary
- The challenge of understanding reading materials available for high school students
- Unfamiliarity with project-based learning such as working in cooperative learning groups, creating models, making posters, and giving oral reports.

Challenges

As I began with the Concepts Science class, I realized that it would take a while for the students to get used to being in school and working with each other. One problem, for example, had to do with cultural differences between my Somali and Salvadoran students. One day a Salvadoran boy whistled at and told one of my new Somali girls how beautiful she was. He was being playful and meant it as a compliment,
but she was very embarrassed and insulted. Her brother wasn’t happy about it either. After much discussion the two groups of students began to understand what was appropriate and inappropriate in each other’s cultures. Even with this new knowledge, incidents continued to occur and had to be dealt with. An additional problem that occurred frequently at the beginning of the year was that students would get up and walk around when they felt like it, even if the teacher or another student was speaking to the class. Or a student would sharpen a pencil during another student’s presentation. Each time, it was necessary to take the time to talk about respectful classroom behavior. Sometimes the problems occurred outside the classroom. One day one of my Somali girls got into trouble for trying to break in line in the cafeteria. I had an assistant at the time and we set up a classroom situation to model the importance of not breaking in line. It was critical, especially at the beginning of the year, to deal with all of these behavioral issues so that content learning could take place.

Another area that was challenging for my students was that they didn’t have a lot of English vocabulary to help them learn the science concepts. Because of this, it was necessary to spend a great amount of time building oral vocabulary. Doing this in science was actually fairly easy since I could find lots of objects and pictures for much of the vocabulary. Even challenging concepts such as the steps in the scientific method could be illustrated through pictures from National Geographic magazine that the students themselves chose. We also spent a lot of time doing simple experiments and recording data and results on graphic organizers. Science kits provided by our school district also helped build vocabulary for studying about such things as plants and butterflies. From experience I learned that it was necessary to frequently refer to previously learned vocabulary in order to make sure that it was really in the students’ long-term memories. All of these hands-on activities help the students retain vocabulary far more than traditional readings and worksheets.

**Strategies for Building Vocabulary**

As I worked with the literacy students, I discovered another strategy that helped them learn science vocabulary more effectively. I used Carolyn Graham’s *Content Chants* that accompany the *Oxford Picture Dictionary for the Content Areas* during our study of Biomes and found that the chant, “I’d Like to Live in the Polar Zone” helped them to remember important information. When I asked questions about the biomes included in the chant, they could answer them orally, showing me that they had learned important information.

While the students could tell me the important information they had learned in the chant, many of them were still unable to read the text of the chant or read a simple question about the text or answer that question in writing. This led me to search for ways to help the students learn to read words that they were familiar with orally. In order to increase the student’s familiarity with important science words, we created a word wall, by writing the words and drawing a picture of the concept on an index card. These cards were placed in a slot chart which hung in the classroom. The students illustrated words from our plant unit, such as tree, stem, flower, root, and seed. Making the index cards and then looking at them day by day, helped the students make the connection between the word and the idea. We also read the words aloud and talked about the beginning, middle, and ending sounds. Sometimes we wrote short passages together on the board about our topic for the day and then read our writing together, again often focusing on the letters and sounds as well as other important aspects of writing such as indenting, capital letters, periods, verb endings, etc. After seeking advice from an elementary school teacher, I began using Wikki Stix, long, thin waxed sticks,
that students could stick on the board or on newsprint to help teach the class an important point. I might ask, for example, "Who would like to go to the board and put a wikki stick under a word that rhymes with "boot?" One of the students would volunteer to put the waxed stick under the word "root." This emphasis on building the word recognition and reading skills was a very important step in learning the science concepts.

In addition to creating our own reading materials as we wrote what we were learning on the board and on newsprint, I began to search for science books that the students could read independently or together as a class. When I first started working with limited formal schooling students, it was very difficult to find materials that were easy enough for the students to understand, even if we read the books together. I would often have to check out books and then rewrite them, using simpler vocabulary and sentences. However, even in the few years that I have been working with limited formal schooling students, there has been a great increase in science materials that are appropriate for high school ESOL students. After borrowing books from the school library, the public library, and our district's ESOL resource library, I began to be able to recognize materials that my students could read and enjoy. First of all, I found that it was important for the books to be visually appealing to my students. They liked beautiful, colorful, and scientific drawings as well as photographs. These visuals gave invaluable clues when the students began reading the books themselves. They did not like books with lots of pictures of very young children. They told me on several occasions that those were for kindergarten. It was also important that the books have simple and predictable sentence structure and that they used important science vocabulary.

As we read the books together, I developed a routine that helped the students get the most from the text. First we began with a pre-reading activity as suggested by Pauline Gibbons in her book, *Scaffolding Language, Scaffolding Learning* (Gibbons, 2002). Either individually or as a class, we brainstormed what we knew about the subject of the book. We looked at some of the pictures and the students talked about personal experiences they had had. For example, when we were reading about spiders, students talked about spiders in their countries and whether or not they were afraid of spiders. Then I would read the book aloud, pointing to the pictures and asking questions, while they followed in their own book. After that first reading, sometimes the students read the book again by themselves or with a partner. It was also important that the students do something with the content of the book. Graphic organizers, crossword or other puzzles, or mini-presentations on a portion of the book helped the students understand and remember the content. In fact, it was this part of the routine that my students liked the best. Most effective were activities that encouraged the students to put into their own words what they had learned.

**Introducing Problem-Based Learning to ESOL Students**

In addition to building vocabulary, students needed to learn how to work together and complete group projects. The first year that I worked with limited formal schooling students I discovered that they were not used to a lot of the project-based learning that we use in the United States. Working in cooperative learning groups, creating models, making posters, and giving oral presentations were not familiar learning activities. It was very important that when I gave them a project that I model the process for them. If I wanted them to make a poster, then I needed to show them a poster. If I wanted them to do an oral report, I needed to do an oral report for them. If I wanted them to make up a chant, I had to make up one first. One of these projects, the biome project, exemplifies a lot of the strategies that I have outlined so far in this paper. I have been
very fortunate this year to work with another ESOL teacher who also teaches Concepts Science. She and I worked together to develop the biome project. First, we introduced the concept of biomes as a place which is a habitat for a particular group of plants and animals and has a certain kind of climate. The students shared information about plants, animals, and climate in their countries. As a class we learned a little about each of the major biomes and learned some basic vocabulary. There seemed to be so much to cover but I learned not to rush. I wrote in my journal in November, "Yesterday I don't think they really learned the vocabulary about the Arctic. We spent more time on deserts and I really felt they understood the vocabulary (camels, oasis, dunes, etc.). I think I rushed too much yesterday."

After helping the students gain basic vocabulary (with our word walls, pictures, chants, daily writings and readings), they were ready to do an in-depth study of a biome on their own in their table groups. We had collected lots of materials on each biome (easy to read books, more challenging books with great pictures, National Geographics, etc.). We also brought in materials for them to use: Xerox box tops as a structure in which to create the biomes, sand, sandpaper, cotton balls, pipe cleaners, clay, colored paper, yarn, etc. First each group had to fill in graphic organizers on their biome which asked about the plants, animals, climate, and other interesting information. Then they went to work creating their biomes. They knew that they would have to tell the class about their biomes so they needed to know the names of everything in English. They also had to write a paragraph giving the same information.

Three out of the five table groups were very engaged in the biome project. Two groups pulled things together at the end of their allotted time and all of the groups took pride in telling the class about their biome. We had a microphone available for them to use and they really enjoyed using it, sometimes surprisingly, even the shy, quiet students. The microphone also made it much easier for everyone to understand.

After I had completed the biome project, I found some independent research that supported some of the techniques that I had used. Freeman and Freeman, in their book, Closing the Achievement Gap (Freeman and Freeman, 2002), strongly recommend the use of themes to develop academic language and content knowledge. One strong advantage of this approach is that basic vocabulary related to the theme is naturally repeated and reinforced. In the biome unit we were constantly using words like "habitat," "climate," "flora," and "fauna," "temperature," and "rainfall." It is also important that the theme be interesting and relevant and meaningful to the students. Most of my students found it interesting to learn about the plants, animals, and weather of various biomes and enjoyed sharing what they learned with other students.

Summary

In summary, when working with limited schooling students it is very important to pay careful attention to what the students know and what they don't. Sometimes it is necessary to spend time teaching expected school behaviors, routines, and procedures. It is also important to make sure that students have a good background in the vocabulary of the area being studied. Time spent on building this vocabulary will be well spent and it will be necessary to make sure that certain basic vocabulary is used again and again. Selecting books that are age appropriate and have simple, repetitive grammatical structures will allow students to know the accomplishment of reading books on their own and pulling information from them. Making sure that these students really understand what is being asked of them is imperative. Clearly showing students how to make posters, models, and give oral reports will ensure better student work and is well worth the time and effort.
References