ELIZABETH WERNER, *University of Connecticut*

Making Connections & How Much is Too Much?

A Success

Looking back on my own science education, I would say that the majority of my teachers were people who were very passionate about the field of science, but either didn't or couldn't work directly in the field for whatever reason. (I now personally suspect that some of them warmed to the idea of having their summers off and didn't know what else to do with a degree in biology besides rack up more student loan debt.) Fortunately, the other science teachers I had were people who loved not only their subject, but also the art and craft of teaching. These were the people who inspired me to wonder, observe, and examine the world around me. From these experiences, I learned more than just facts and theories—I realized that the concepts and ideas central to the discipline of science not only pertained to my life, but involved my life as well. I discovered that the information I was gathering actually meant something to me because it helped me make better decisions, fashion advanced explanations for events I witnessed in nature, and to critically examine claims and findings.

Today I am the science teacher, the one with the potential (and the choice) to make science learning meaningful for my students, or to "fill them up" with disconnected bits of fact that they will no doubt only memorize for a test. With the pressures of state and national testing looming over me, it would be easy to justify covering the content over teaching the child. But unless we are able to provide a connection between our students and science information, and also help them create this link for themselves, then we are not truly succeeding in teaching science...no matter what the test results report. I believe this is the most successful aspect of science education today: more and more teachers, publishing companies, and state standards are moving away from a focus of the memorization of facts and toward a bigger, broader picture that is centered and grounded by how science affects our lives. We are accomplishing this not by bringing the science to the students' lives, but by the reverse. We are centering our lessons and units on a current issue, event, or question that is either of interest or concern to our students, and as a result, we are setting them up with the motivation and drive to learn. For example, rather than pushing through DNA instruction bit by bit, centering this study around the question "Is cloning always bad?" makes the content much deeper and more relevant to the learner. It also lays the foundation for critical thinking skills by providing an authentic opportunity to analyze the information learned, rather than simply memorizing it. The classroom is no different than "real life" in that anything without meaning is quickly forgotten or discarded. Playing an active role in the move away from teaching techniques like mnemonic devices and the shift toward authentic experiences in the classroom is the greatest part of teaching science today. It motivates me to think more, do more, wonder more, and discover more as I strive to create an environment not just where science is learned, but where connections to science are created and strengthened.

It is not my intention to say that as a profession we are completely successful when it comes to connecting students and science content. Unfortunately, there are still teachers out there who view their work in the classroom much like the majority of mine did. With this in mind, I must concede that there has been and continues to be many challenges and setbacks as we strive to make science learning more meaningful for students. However, as I review the history of science education, I see not a pendulum swinging back and forth between ideals, but a steady progression toward this goal. From the Discovery Learning methodology, we learned the importance of providing our students with experiences that did just that—encourage them to experience science. From Inquiry we have learned to help our students ground these experiences around content, make observations, and conduct their own tests. We are now really just beginning to recognize and include the diversity inherent in our classrooms. But to be moving at a steady pace in a direction that motivates students to learn content that will stay with them long after they leave the class room, is a success within itself. When will we completely meet this goal? Will the test scores be better when we do? I don't know. I doubt that there will be any questions on the upcoming CMT (Connecticut Mastery Test) regarding how my students' feelings about stem cell research changed throughout the course of our unit on heredity and evolution. But if there was, I am confident that a great deal of them could and would support their responses with the facts and concepts they have learned, and more importantly, the ones with which they connected.

ELIZABETH WERNER, *University of Connecticut*

Making Connections & How Much is Too Much?

My Vexation

"Tell me when…" I instructed my nephew as I poured him a glass of juice. He waited until the red colored liquid reached that imaginary line of juice level perfection and let out an emphatic "WHEN!"

If only I knew "when to say when" in regards to teacher support with Inquiry. By giving too much support, we're teetering on that slippery edge of scripted lessons, which defeats the whole methodology of Inquiry. But by giving too little, we risk that a teacher who is uncomfortable with her own science knowledge or with the practice of Inquiry will feel unsupported; the hallmark of anything doomed in education.

Recently, I was given the opportunity to work on an Inquiry project for a professor that will hopefully end up as something classroom teachers can use to teach simple machines through the Inquiry method. When preparing to introduce the teachers to the program, the topic of an instructor manual surfaced in our conversations. One line of thinking was that very little guiding should be done. This way the teachers would be going through experiences that somewhat mirrored their students: namely, rather than consult a text for an answer, the teacher would experience the art of testing something out and observing the results, modifying as needed. Another line of thinking countered that giving the teachers too little support might cause content to be missed or incorrectly covered. This side suggested that a guide of a probable timeline and the content concepts that should be covered would provide a better starting point for the teachers, enabling even the inexperienced teacher to succeed with the unit.

In some ways, this is a difficult argument for me to take on a definitive position. I certainly see the creative freedom in the first point. Every teacher should be given the chance to develop and refine their own style and approach in the classroom. To give and expect explicit compliance with lesson instructions and outcomes is unreasonable at best. In my experience, I have always viewed finding a lesson in a teacher manual or other source as finding an idea. I very rarely follow a lesson exactly as it was written, and if I do, I usually make changes the second time around. Teachers know how and when to make these adjustments based on their audience; this cannot be completely built into a lesson plan. To give explicit directions in a lesson plan also implies that all teachers do is perform or carry out produced lessons; something that doesn't take very much expertise since just about anyone can simply follow the directions and do what it says to do.

However, I also see the application benefits embedded in the second idea, which provides a somewhat detailed guide for the teacher. While it is true that teachers creatively perform the aforementioned tasks of modifying their lessons as needed, it must be noted that this is best accomplished with experience. Most teachers would agree that experience is paramount to their success in the classroom and that they became a better teacher as their career progressed. I personally look back at that first group of kids I was given and wonder who learned more that year: them or me? It took me at least a year to figure out what I was trying to teach, and it's taking even longer to figure out the best way to teach it. There is also the issue of teacher misconceptions in science. As the subjects I teach change, I am continually addressing new information as a learner myself. I worry that without providing teachers with the content and conceptual outcomes for the unit, specific information may be misrepresented or omitted not only because of teacher inexperience with the material, but also because of a low level of comfort with the Inquiry method. Without providing a basic skeleton of what the students should be learning, isn't it possible that content coverage might not reach the depth it should simply because the students' inquiries take them in a different direction? If the purpose of the method is to learn the content, is this acceptable?

I have been unable to find a personal consensus regarding this issue. Like students, each teacher is different and desires a different level of support, depending on the subject and level of experience. Is it possible to make the "one size fits all" lesson? If we give too much support will the method lose out to the content? If we don't give enough, will the content lose out to the method? In a perfect world, there might be an imaginary line of support and we would know just when to say when.