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Table of Contents

Dr. Johnny L. Mattox.....	<i>Introduction.....</i>	Page 1
Patricia D. Bradway....	<i>A Different Approach to Teaching and Learning.....</i>	Page 2
Kathleen M. Grossman....	<i>International Perspectives in Science Education.....</i>	Page 3
Matt Lochen..	<i>Disparities in the Origins of Man..</i>	Page 4
Jess Wysopal....	<i>Training Kids Like Horses.....</i>	Page 7

Introduction

One of my most enjoyable experiences during my years of teaching has been instructing “Advanced Methods of Teaching Science”, EDSE 646, at the University of Mississippi. This fall I have left the class each week inspired to be a better teacher after witnessing the enthusiasm shown by my students for teaching.

This year’s class has shown a great deal of diversity in teaching styles and delivery. However, each teacher has shown ability to deliver very effective instruction. I am certain that each instructor will continue to grow professionally through years of teaching, effectively helping turn on that “light of knowledge” in students.

Included in this year’s journal are Patricia Bradway (biology, Amory High School), Kate Grossman (biology and genetics, Southaven High School), Matt Lochen (physical science and environmental science, Southaven High School), and Jess Wysopal (biology and chemistry, Simmons High School).

The articles which follow demonstrate some of the interests and research endeavors of these teachers, illustrating their interest and enthusiasm for teaching. I applaud each one of them for choosing education as a profession and am certain that they will make a difference in the lives of countless students.

A DIFFERENT APPROACH TO TEACHING AND LEARNING

BY PATRICIA D. BRADWAY

I HAVE OFTEN HEARD THAT THE BEST WAY TO LEARN SOMETHING IS TO TEACH IT. THIS TRUISM WAS PUT INTO PRACTICE RECENTLY BY A FELLOW TEACHER. THIS TEACHER PROVIDED HER ANATOMY AND PHYSIOLOGY STUDENTS WITH THE OPPORTUNITY TO TEACH AN ADVANCED PLACEMENT LAB ON OSMOSIS AND DIFFUSION. MY BIOLOGY STUDENTS WERE AMONG THE PARTICIPANTS AND RECIPIENTS OF THIS PEER TAUGHT LAB.

THIS TEACHER AND I ACTED IN A SUPERVISORY CAPACITY. THE ANATOMY AND PHYSIOLOGY STUDENTS HAD PREPARED FOR THIS THREE DAY LAB VERY THOROUGHLY. THEY PROVIDED VERY CLEAR INSTRUCTIONS WHICH WERE WELL RECEIVED BY OUR STUDENTS. MY STUDENTS FELT VERY COMFORTABLE ASKING QUESTIONS OF THEIR PEERS. THEY ALSO SEEMED TO BE VERY ENTHUSIASTIC ABOUT THE SESSION.

THE ANATOMY AND PHYSIOLOGY STUDENTS WERE CONFIDENT IN THEIR ABILITIES AND COMPETENT IN ANSWERING THE QUESTIONS THEY WERE ASKED THUS EXHIBITING A LESSON WELL LEARNED THROUGH A LESSON WELL TAUGHT.

INTERNATIONAL PERSPECTIVES IN SCIENCE EDUCATION

Kathleen M. Grossman

12/3/2005

This article is written in honor of Nepal, the country where I spent two years teaching science. In Nepal, science is relegated to pure rote memorization. Nonetheless, the importance of “hands-on” learning is not entirely foreign to the education system. For instance, the government spent a considerable amount of money on lab materials that were distributed to many schools throughout the country. However, the lab materials were often left unused and sometimes unopened in their boxes due to lack of knowledge about how to use and incorporate the materials into the science curriculum. An example of such a scenario was told to me by the local SEDU chief. (SEDU stands for Secondary Education Development Unit.) The SEDU chief in my district told me about how the wife of a headsir at a school he visited used the glass aquarium from the science lab as a display case for her many colorful bangles. While the aquarium was not used to serve the purpose it was designed for, at least it made it out of the box.

As a result of my two years of Peace Corps experience, I am curious about international perspectives in science education. A quick search on the Internet made me realize that the term “inquiry-based learning” is not just a buzz phrase in the United States – but in many countries throughout the world. From my science methods class, I have learned that the science curriculum in many European countries does not emphasize “covering content” like the science curriculum in the United States. While the science curriculum in the United States is undoubtedly experiencing a shift from memorization and covering content to inquiry-based learning, we are still in the midst of that transition. Like other countries, the United States science curriculum still falls into the hands of memorization’s wrath. As a biology teacher in Mississippi, I have experienced firsthand the push toward covering content. That emphasis is largely a result of the state-mandated tests required for graduation.

In order to gain a greater appreciation of science, students must be exposed to more than just surface details and have the opportunity to explore content in depth. Are we in the science education community failing our students by overemphasizing content? By overemphasizing content, are we reducing science to sheer memorization? Is our curriculum really that different from a country such as Nepal where memorizing is the primary means of “learning”? These are questions that we as science educators must ask in order to speed up the transition to inquiry-based learning.

Disparities in the Origins of Man

Matt Lochen

The following article represents a personal view on the debate surrounding evolution and intelligent design that has been cropping up in Delaware, Pennsylvania and many other states across the country.

I come from a small town in Wisconsin, and in many aspects, I consider myself to be a privileged white male. Both of my parents graduated from major Midwestern universities and could afford to send me to a private Catholic school where I spent nine years soaking up theology like a sponge. My classmates and I attended mass several times a week and spent an entire class period studying our religion every day. Among the topics we studied was the story of creation. Adam, the first human being, and Eve, created from the rib of Adam; the serpent who tempted Eve into eating the forbidden fruit; and the casting of Adam and Eve out of the Garden of Eden. Oh, I remember it well. What I don't remember was learning anything about evolution. Even in our science classes, the theory of evolution was mysteriously left out of the text. As far as I knew, according to science and the rest of the world, the entire population descended from two individuals.

All this changed when I entered high school. There were no Catholic high schools in the area near my hometown so I enrolled in the local public high school. My experience at the local high school was the antithesis of my experience at the Catholic grade school, at least as far as the creation/evolution of man was concerned. It was in my high school biology class where I first encountered the theory of evolution. I had the opportunity to learn about Charles Darwin and his theory of natural selection. I learned about the birds and tortoises of the Galapagos Islands. Man evolved as a result of millions, perhaps billions, of years of evolution and his earliest descendent was not Adam but rather a tiny microbe that arose from the primordial soup. We watched educational videos about Homo habilis and Homo erectus and made phylogenetic trees. My academic career at the University of Wisconsin provided more of the same. We learned that "Lucy," was the

oldest known human-like ancestor, not Adam. While I found evolution nothing short of fascinating, I still found myself asking this simple question: So which was it? Adam and Eve or the primordial soup?

The controversy surrounding the Northeastern states stems from a school board ruling that the theory of intelligent design should be taught along side evolution in public schools. The Dover school board argues that students should be presented with both theories and decide for themselves which one to believe. Opponents say that intelligent-design stems from a faith based perspective and has no room inside the walls of a public school classroom. To teach intelligent design would be unethical because it would violate the separation of church and state. Not since the Monkey-Scopes trial of 1925 has evolution versus creationism received so much national attention.

Until I moved to Mississippi to become a high school science teacher, I was able to tuck this argument into the back of my mind and go about my daily business without a second thought about evolution or creationism. However, this changed as I paged through my new teacher's edition text book and found the theory of evolution on page 112. There was no mention of intelligent design. Great! Problem solved. I'll go by the book, after all, it was a public school. So I taught about Darwin and his theory of natural selection, I passed out National Geographic issues that had articles on the earliest human-like ancestors, and we discussed the archaeological dig which brought Lucy into the limelight. It took no more than a few class periods and my principal was at my door. He informed me that I needed to stop teaching evolution, "because we all know it's a bunch of garbage anyway." I was stunned. I simply taught by the book, just as my high school teachers did. What had I done wrong? When I asked if he'd rather I present both theories with equal attention, he told me that I was better off ignoring the whole issue. "The students know where they come from and they don't need some textbook filling them with foolish ideas," he said.

So when I hear the arguments in Pennsylvania and Delaware I wasn't surprised. I had run the gamut. Initially I was taught nothing but the theory of creationism (much like

intelligent design), then in high school and college, I'd been taught that evolution was the answer, and here in Mississippi, I was told to teach neither of the theories. Besides bewilderment, I have learned from my experiences that what ever teachers end up telling their students, there must be standardization across the entire nation. As is, there is far so much fragmentation of science curricula that one need only to move across town to a different school, let alone a different state, and he or she may be taught a completely different view on the origin of man. If we're going to teach both theories then we need to teach both theories not only in Delaware and Pennsylvania, but in all other states including Wisconsin and Mississippi. A standardized curriculum would not only eliminate the guess work when teaching science, but it will also unify the nation's scientific community. Only when we standardize the countries curriculum can true collaboration take place among our future scientists.

Training Kids Like Horses

Observations:

1. 100% of my students are in the free and reduced lunch program.
2. I teach Biology I, Biology II and Chemistry I.
3. My class sizes range from 11 to 26, with most at the 26 end of that scale.
4. About half of my students were able to purchase brand new binders for class.
5. About 40% of my students reused binders that had seen better days.
6. About 10% of my students never obtained a binder for class.
7. My classroom cabinets are mostly empty but for science litter from the 1960s.
8. I started the year with one thermometer, which was broken in the first week and one rusty balance, whose accuracy was questionable.
9. On their information cards, most students wrote in "science" for their least favorite subject.
10. When I mention a physical science concept in class because it relates to our lesson, often students will volunteer that they remember that from the year before.
11. The students noted in #8 are generally the brightest in the class.
12. When I ask students to brainstorm a solution to a particular problem, students are more likely to generate an 'old wives tale' explanation rather than a logically deduced one.
13. Students rarely complete work unless given class time to do it. Homework is returned less than fifty percent of the time.
14. Most students openly confess without shame to not studying for tests.
15. Only about a quarter of failing students come to after school tutoring.
16. Lab activities are seen more as fun activities than a means of exploring a concept.
17. Students diligently copy notes during lecture.
18. Many students attempt to answer questions during lecture.
19. Failure to correctly answer review questions is usually due to failure to utilize the correct words/terminology.
20. Writing the answer is even more difficult if the students are not copying it directly from their notes.
21. A few students ask thoughtful questions related to the topic at hand during a lecture.
22. Nearly all students have failed at least one test or quiz.

These are just a few of the observations that I have made in my on-going experiment in the classroom over the past three months. My children are economically and academically disadvantaged. They lack basic logic skills and have apparently only ever been taught by one method: Read, Remember, and Regurgitate. Of course this method of getting by in school is only enough to get the student his/her immediate grade, but in the long run it actually seems to compound their lack of intelligence simply because they never developed the tools to perform higher level thinking skills.

By this point in these student's academic development, they are often dismissed by many as incapable of performing in school and written off or more frequently just passed on to the next grade level. This method of course is well-known as a failure in the education system. It also sets the kids themselves up for failure when they discover that real work requires far more of them than their schools ever did.

So what to do with these children? How do you teach them? How do you bring these children up to their grade level's functioning ability? It is a monumental task, but the first thing you have to do is change your expectations. Don't expect all this to happen in one year, but do expect every student to improve in logic, processing and writing skills. Don't expect the students to remember every detail

unless you give each detail ten minutes of your time, but do expect the students to grasp the concepts and restate their uses in nature or everyday life. Don't expect to 'save' kids by teaching them a lot of material, expect to teach kids the skills they will need to 'save' themselves in this world. Don't expect miracles, but plan for them anyway.

There are two key things here for reaching children that are not performing academically at the high school level and they both relate to horses. I have ridden and trained many horses and thus I think of teaching in the context where I first learned to do it. In fact, training horses is very pertinent to teaching children who are behind because when training a horse you can't just explain what you want and expect the animal to do it. You must create situations for the horse where the only option left for it is to choose to do what you want it to do. Then, by consistent rewarding, it will willingly perform the taught maneuver and incorporate the lesson into its common knowledge base. This is the first key idea in reaching children working from an academic disadvantage. You need to create classroom situations and atmosphere that eliminate the options for a child to be lazy or refuse to do work.

For example, my largest problem is getting my kids to do work outside of school. Seeing this problem, I slowly begin to close off paths students use to avoid homework. First and foremost, I reward hard and diligent work in my classroom, so every homework or assignment is graded. For those who simply cannot remember, I ask them personally about their homework every time I see them outside of class. I make these kids write the assignment down before they leave the classroom. I establish an individual relationship with each kid who has trouble getting his/her work into me so they see a warmer side to me and know I care about them. Then, if these tactics do not work, I resort to harsher tactics. I can employ these with little disruption to my class because by now these kids know I like them and have had me harping on them so long, that they know this is the direct consequence of their inaction in the homework department. Harsher action usually entails one of two things, either a call to their parents or academic detention. The call to the parents usually takes care of the wayward students, while the academic detention takes care of the lazy ones.

So, the doors close around these kids until they can only go through one and that is the one I want, namely to do their homework. However, just as important as engineering this feat is to reward its results. When a student begins to bring in homework, I lavish them with jokes and praise to give them affirmation in their new behavior. I have reward tickets that I give out as well and these could possibly earn the students rewards. Everything is designed to keep the students moving in the direction that I want them to go. Their usual path of least resistance has not changed but rather their destination.

This whole idea also is like the phrase, you can lead a horse to water but you can't make it drink. I have had someone argue this point with me saying that if you put a hot brand on the horse's rear end, it most certainly goes forward and drink, implying that you must have a large enough stimulus and you can make a horse do anything. However, this person had no experience with horses, and if they did they would realize how ludicrous their idea was. In actuality if you put a hot brand to a horse's rear end, all it will likely accomplish you is getting your teeth knocked in when the horse kicks out at the pain. That is its instinct when in pain. If you want the horse to drink there are more subtle ways to encourage the horse to drink, namely exercise it until it works up a good sweat!

The same goes with children, you cannot strong arm them into learning. It just doesn't work to say to a kid, "You will learn this!" It only throws up the kid's defenses, and you will get nowhere with that kid again until you earn his/her trust. You have to be forward and direct in your expectations and demands, but to really accomplish something, you also need a subtle hand at the backdoor to that child's heart. Ask them personal questions in effort to establish a connection. For example, ask about their basketball game last night. Tell them what you noticed about their writing style on an essay question on the test. Ask them where their parent's work. Ask them what they want to do with

themselves after high school. Ask them anything at all...just talk to them as more than a teacher. Pick two or three kids a day and try and get in a brief exchange with them. Before you know it they will be coming to you to tell you this or that. Eventually, they will not want to disappoint you and that will help reinforce the newly acquired habit of keeping up with homework.

The second key idea in reaching academically disadvantaged children is also the key to teaching a horse well. If you start out a lesson and find out that your horse has difficulty performing the required task, back up the lesson to a maneuver that is simpler. Build the horse's confidence with a routine task and come back to the difficult new one later. It may be later in that same lesson or later in the week. Don't defeat yourself and your efforts by killing the horse's/child's confidence in giving out tasks greater than their abilities.

The philosophy with children who are behind in school is that they will have to do what everyone else is doing. Teachers blindly think that these kids will just magically know the material because the teacher taught it well. No matter how well the material is taught, if the child does not have the logic or processing skill to relate the material to other things pertinent in his/her life, the lesson will still only be a Read, Remember, and Regurgitate lesson. That is all the child will be capable of drawing from it. That is not lasting learning, and in fact it is the kind of learning that will kill a child's interest in that subject area.

An example of this in practice is in utilizing writing in the classroom. Often, students do not expect writing to be a skill used outside of English class. I recently assigned the first part of a four part supplemental reading assignment. After reading each part, the student was to write a one page summary on the pages they read. I knew this could be disastrous without any further preparation than these instructions, but at the same time, they had four parts to eventually read and four essays to write. Furthermore, I wanted to see what my student's natural abilities and inclinations would turn up of their own accord.

Only about half the students turned in the assignment as it was something new and a notch up in the level of difficulty of their independent assignments. Of those essays I received, 80% were merely the first three paragraphs of the passage copied, word for word. Of the rest, 10% were grammatically poor, but un-plagiarized attempts to summarize the essay, but when they reached the bottom of the sheet of their loose-leaf (which met the 1 page requirement) they simply stopped, missing many important points later in the essay. The remaining 10% showed true promise in picking out the main points of the essay, but their essays were weavings of plagiarized sentences cut from the passage and tied together with the student's words. Clearly my students did not expect me to read their essays.

So, I wrote long detailed notes of the problems with each essay and suggestions for what I wanted to see next time. Then, I xeroxed several examples on overhead transparency film for students to examine themselves. They relished correcting other's mistakes, while at the same time realizing their own similar errors. Then, with my students knowing I would actually read their essays for content and exactly what was required of them in writing the essay, I assigned the next part of the supplemental reading. It was simply amazing what I got back in the next round of essays. It was all a matter of backing up to what they knew, showing them that they did know everything they needed to accomplish the assignment, and then asking them to go forward again. No confidences were shattered and most students improved over the series of four essays that were written.

Data:

1. Of the 120 students I teach everyday, 38% failed my class in the first quarter.
2. At progress reports in the second quarter, only 32% of my students were failing.

3. Students taking advantage of after school tutoring are reaping the advantages of learning the material well...their grades are going up.
4. Those students who are remaining consistent in their improvement are more confident, more cheerful and most outspoken in class. It is as if they are not the same person.
5. Voluntarily, students verbally affirm that they feel they are learning things in class.

Conclusions:

My students are academically disadvantaged students, but they can and do learn. It is merely a matter of monitoring their needs and current abilities in order to engineer lessons for them that allow for one step at a time. It is not a matter of lowering expectations...it is a matter of changing the parameters in which they are taught. You can expect a lot of them, but under different circumstances. The difficult part is getting them over that first hill where they don't think they can do the work or are too lazy to try. After that first hill, you have inertia on your side pushing them to achieve because they've seen they can and know what they need to do to meet your standards.

It sounds a little callus to compare teaching to training a horse or any animal for that matter, but it all boils down to behavior modification. Under that title, it is seen as a time honored subject in the sciences, but really what does it matter what it is called? What difference does it make breaking the methods all apart into words and analyzing them? What is really important is helping kids improve academically...helping kids build processing skills to learn in school...helping kids have confidence to tackle any problem that life will present them.