HUNBlog: Thoughts on Science Education

From the Houston Urban Network for Science, Technology, Engineering and Mathematics

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HUNBlog is a blog on issues and news in science education, and on science in general.

HUNBlog is part of HUNSTEM, The Houston Urban Network for Science, Technology, Engineering and Mathematics. You can find HUNSTEM at: http://hunstem.uhd.edu.

Everyone is welcome to join in the discussion, so come on, let's blog!

My name is Brad Hoge, and I'm the one writing most of the blogs on this site. I have a Ph.D. in paleoecology and an M.Ed. in curriculum and instruction. I teach science education, geology and biology at the University of Houston Downtown, and I've taught at every age level at one point in my life or another, including preK, elementary, middle and high school. I also worked at Houston's Children's Museum for a short time. I was a full-time parent for nine years, and I'm a poet, by hobby. This odd background gives me a unique perspective on science education, and I'm not shy, so you never know what you'll find here.

Come on, let me know what you think!

This book is entirely my own writing, but there are a lot of other great ideas on HUNBlog contributed by Houston area teachers, my students at UHD (pre-service teachers), high school students from our START programs at UHD, and more. Check out HUNBlog at: http://hunblog.typepad.com/hunblog. Use the cloud to find teacher and student blogs. Comments have not been included in this collection, but there are some doosies. Check out what others have had to say about my ideas, and leave your own comments. It's never too late!

You might also like to check out the Carnival of Education for weekly synopses of the best blogging about K-16 education.

HUNSTEM is a program of the **Urban Center for Student Success in STEM** (UCSS/STEM) at the **University of Houston – Downtown** (UHD).

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November 16, 2005

The disconnect between formal and informal science education

Ask most scientists what inspired them to become scientists, and they will most likely tell you about an informal experience, a museum, zoo, park or travel experience. What encouraged me to become a scientist was the experience of going into the field with my father. He made maps for the U.S. Geologic Survey in Kentucky and New Mexico, and I tagged along.

My own kids have visited lava fields, seen petroglyphs, and searched for fossils in the Sacramento Mountains as well as going to zoos and museums across the country. They have had many of these experiences even before entering school. Their experiences are shared by many students in every school, but not by all. The advantages these students have over those without prior informal education experiences are obvious. They are more prepared to enter a learning environment, more confident in their learning ability, and more eager to learn in general.

We need a way to provide these advantages to all students, and the sooner the better!

The pedagogy of constructivism comes from the idea that we learn best by doing, therefore constructing our own understanding. Informal science education has been based on this philosophy from its inception, and we know that it is effective, though hard to quantify.

There is general agreement that we should encourage teachers to incorporate more field trips into their curricula, and that we should emphasize project-based learning in school curricula at every level. So why don't we? The answers usually include budget and safety concerns, as well as the problem of time. There is concern that the benefits don't warrant the amount of time and money invested when the results cannot be effectively tested for.

Even when teachers do take their classes on field trips, these trips are looked at as "breaks" from the regular curriculum. Teachers often disconnect from their classes once they arrive at the informal science institution. Docents at the institutions then take over the teaching role. This disconnect is obvious to the students, and diminishes their expectations of the trip.

What we need to do is find a way to involve teachers with the educational value of the field trip experience. Teachers need to benefit from the field trip as much as the students. Informal science centers need to pay as much attention to the teacher's needs as well as to the student's needs. Field trips are excellent opportunities for teachers to gain experience with hands-on project-based learning techniques. Teachers will gain confidence in the application of these techniques to their classrooms, as well as gaining confidence in their ability to utilize these techniques.

Eventually, these benefits will become more obvious to everyone involved, and maybe, just maybe, we can build more of these experiences into the formal curriculum.

Let's give it a try! Check out the many Informal Science Centers in Houston (http://hunstem.uhd.edu/ISE.html) to find out what you can accomplish!

December 05, 2005

What Do Students Need to Know?

I recently returned from a conference at the Charles A. Dana Center in Austin, Texas, and there was much discussion concerning what knowledge was necessary in mathematics for students entering college. It seems relevant to ask this question for science as well, and I thought about it for the introductory biology and geology classes I've taught. For the life of me, I can't really think of any truly "necessary" prior knowledge one must have to do well in these courses.

Skills, yes!

Students must be able to think effectively in space and time. They must have a keen understanding of probability, and they must be able to distinguish useful information from psuedoscience. With these skills, I can teach them the details, but without them, I will spend most of my time trying to overcome misconceptions and poor reasoning.

There is certainly a "ton" of stuff for students to know in biology and geology, but this knowledge is just one tool needed to effectively ask new questions. Science literacy, both for future scientists and for voting citizens has more to do with the ability to use knowledge than with the quick recall of it.

We must teach for literacy!

This means we must teach the framework for understanding. We must teach the "big" ideas such as evolution and plate tectonics. We must teach reasoning skills, which means we must ask open-ended questions (this begs the topic for my next blog, Teach In Spite of Testing). We must avoid teaching knowledge as a checklist of facts, rather we must teach knowledge within context so that its usefulness is obvious.

When we talk about what knowledge students need to do well in math, we are also talking about skills. The information that accompanies these skills in math are harder to separate since the skills are more formulaic, but even for math, students who "get it" can learn faster than those who must "make up" for a lack of skills. The same is true for science. In math, we test for skills by asking for the information derived by them. The same logic does not apply to science. Recalling information does not necessarily indicate understanding.

This is why Hands-On, Minds-On project based science is the way to go! Read more about it at HUNSTEM's Constructivism page (http://hunstem.uhd.edu/CONSTRUCT.html).

January 05, 2006

OL? EL?

I recently visited a 5th grade classroom to do a hands-on lesson on fossil reconstruction. I met with two classes, one designated EL and the other designated OL. I gave groups within each class two dinosaur fossils; femurs, mandibles, ischia, etc., and had them recreate (predict) the original animal. I told them how paleontologists use clues in bone and tooth structure to make such hypotheses, and then I let them come up with their own ideas. The differences between the way the two groups worked and their results were striking to me. The EL groups were very creative. They speculated about color, integument structures and behaviors. The OL group did not tend to consider characteristics that could not be predicted by the evidence they had to work with. Students within the EL groups argued for their own ideas without really listening to the others in their groups. The OL students collaborated more effectively. Both groups ended up creating essentially similar animals from the same bones, but they reached their conclusions differently.

Which is better?

The justification for separating students into EL and OL groups is that the EL students are higher achieving and the OL students need more help. This designation is based on our societal biases towards intelligence. These biases are not always consistent with achievement, however. EL kids do better on standardized tests and do tend to learn quicker, but do not always achieve higher grades or end up more successful in their careers. OL kids may tend to struggle with some concepts and move at a slower pace, but they often end up with more complete understanding of their subjects without gaps and misconceptions and are better able to apply what they've learned to real world situations.

The differences between the two groups are due more to styles of learning which are better adapted to different aspects of how schools teach than to real measures of intelligence or ability. Classifying students as EL or OL is a double-edged sword at best and completely fallacious at worst.

Perhaps a better designation of these two groups would be Creative Learners and Concrete Learners (RL and CL). These differences were striking in my experience. The Creative thinkers did think "outside of the box" and came up with some interesting ideas, but their fundamental designs were no more well reasoned than the more expected results of the Concrete thinkers. In the real world, each type of thinker will succeed and contribute to the advancement of science.

Every field of science has a wide variety of skills and styles that are necessary to advance the field. Just as in music, literature and art, the concrete thinker and the creative thinker both make major contributions. Geophysics often requires more concrete thinking while historical geology allows for more creative thinking. The same can be said to apply to biochemistry vs. population ecology; or cosmology vs. astronomy. Engineering is a prime example of an endeavor that benefits from both creative and concrete thinkers. And I am not separating "innovators" from

"builders", I am describing different pathways to innovation and different perspectives on the applications of science.

If you don't believe me, check out How People Learn. It is an excellent resource for telling us how we each think as well as how we should teach. Recognizing our own skills and styles as well as those of our students is crucial.

Separating students whose abilities and styles differ makes sense, but the designation of these differences based on expected achievement is detrimental to the students and to science. How many of these concrete thinkers will believe science and engineering is an available option for them if they are told they are "On Level" compared to their other classmates. Since I happen to know these kids, my son is one of them, it is obvious that one group includes the students with an interest in science while the other group contains students who expect different careers. The fun each group had with my lesson was the same, however, and as an educator, I see no more reason to discourage the OL students in math and science than I do to discourage the EL students from farming or business. Yet the OL kids have already been told that they are not as good in math and science, and they have already concluded that these subjects are less possible for them in their futures.

What a shame.

January 17, 2006

And further more!

My last blog discussed, among other things, the discernment of students who are expected to pursue science and math careers from those who are not by 5th grade. As in any attemt at tracking students by proclivity, there is inherent discrimination in this practice, but does it start in 5th grade?

The answer is definately no. In fact, it starts before students even enter school. By the time students enter Kindergarten, there is a distinct disconnect between the experiences of middle class students from poor students. By the time most middle class students enter Kindergarten, they have already visited zoos, museums, parks and nature centers. Poor children do not have most of these opportunities. I have seen the effects of this discrepancy on students in the classroom. It becomes obvious fairly quickly to those students who have not had prior informal science learning experiences that they have missed something. It affects their confidence and ultimately their self identity.

There are other factors involved in the disparity between educational opportunities between poor and affluent segments of our population, but providing more informal science learning opportunities is an area we can do something about right away. Early Head Start is one proven solution, and should get more funding. Here is another great place to find more information on

the many issues involved, here's an article that provides a good start (http://www.ncrel.org/sdrs/areas/issues/students/atrisk/at600.htm).

Locally, we have many excellent resources for informal science education that provide early childhood learning opportunities. Here's a guide to science resources for preschool through early elementary grades (http://hunstem.uhd.edu/preKto1stGuide.html).

We all need to be committed to providing resources to all of our students early in their lives. It's the only way we are going to close the gaps in student success and science literacy.

January 25, 2006

Cartoon Science

I like using cartoons to teach science. Cartoons are funny because something in them is ridiculously wrong or out of place. In order to find a cartoon based on science funny, therefore, you must understand what would be correct. You can base entire lessons around a single cartoon.

One of my favorites is a Far Side cartoon by Gary Larson in which three fish are peering at a baseball just ashore. One of them is carrying a bat and they are all three looking at the ball with the same emotion in their expressions each of us has felt when our own balls or Frisbees went over fences or onto roofs.

The reason this is funny is that it suggests that the fishes motivation to crawl onto land to retrieve the ball will lead to the evolution of lobed-fins into limbs. We know that evolution does not work this way, it is guided by the "Invisible Hand" of nature, not by motivation, no matter how much we might want it to.

There is also historical irony in this cartoon. It was once thought that acquired traits could be passed on to later generations. This idea was forwarded by Jean-Baptiste Lamarck at about the same time as Darwin's theory of natural selection. Natural selection won out even before we understood the genetic mechanisms involved, but we still see remnants of the misconception of evolution by acquired traits today. This painful state of current understanding, or lack of understanding, of evolution adds even more irony to the cartoon.

So, wrapped up in this simple cartoon are lessons on the history of science, paleobiology, comparative anatomy, genetics and evolution.

Another of my favorites is a cartoon by Sidney Harris in which a scientist has scribbled a complex equation on a blackboard. In the middle of the long and complex equation are the words "then a miracle occurs". A colleague standing next to the scientist is saying, "I think you should be more explicit here in step two."

This cartoon certainly portrays the feeling all scientists have felt at some point when trying to elucidate a complex problem, but for me this cartoon is funny because of its theoretical implications. Sidney Harris may not have been referring to the mathematics of quantum mechanics when he drew this cartoon, but the first time I saw this cartoon coincided with my study of quantum mechanics and the idea of the "measurement problem".

In quantum mechanics, there is a paradox between the possible attributes quantum particles can express, as described by their wave functions, and the actual attributes measured in any interaction. What determines which attributes actually "collapse" is unclear. One speculation is that consciousness causes the wave function collapse. Which then suggests that the attributes of our universe are set only once they are observed by a conscious mind. This led Einstein to ask "Do you really think the moon isn't there if you aren't looking at it?"

Much has been learned since the proposition of this explanation, and the consciousness causes collapse theory is rejected by most physicists as unverifiable, but it still holds fascination for many scientists and artists. It has been claimed that the theory meshes well with ancient Eastern mysticism and philosophy, for instance, including that of Buddhism which includes a belief in the transitory, interconnected nature of all things and the illusion of separation of thought and existence. This is one of the major themes of the book The Dancing Wu Li Masters.

Sidney Harris' cartoon encapsulates all of this philosophical wrangling in twelve words. Wow!

You don't have to know this much about science to find cartoons funny, however. You can still use cartoons with young kids. Looney Tunes contain great violations of natural laws to create humor. The Laws of Cartoon Physics have been compiled by Paco Hope on his site, The Funny Pages. There are also web sites dedicated to the Physics of Superheroes and a book called The Sceince of Harry Potter.

For more info on Evolution go to Understanding Evolution (http://evolution.berkeley.edu).

February 06, 2006

Of Mice and Men

HotCupofJoe at blogspot.com had a very interesting entry on advances in neuroscience that might lead to a treatment for Down Syndrome. His Feb. 2nd blog, "Science in action: Sonic Hedgehog and Down Syndrome" reported on the discovery of a protein that may be able to repair nerve damage that might, among other things, help to reverse the effects of trisomy 21.

This struck a particularly melancholy chord in me. I've taught genetics for many years, and trisomy 21 is a part of the curriculum, but as an evolutionary biologist, I've always seen the phenomenon as a means of introducing a human element to the topic. My wife's uncle had this condition, and though I never knew him it is obvious just how much of an impact he had on her

life. I have always warned my students against thinking about Down Syndrome impersonally, that though it is easy to isolate ourselves and think of trisomy 21 as a dysfunctional trait, those who know someone with the condition are aware of how special these people are and how much we have to learn from them. It has always seemed to me that trisomy 21 is an example of how the variations within our species allow us our only unique adaptive advantage, the potential for true altruism.

I have heard people with Down Syndrome described as "love savants". They exhibit pure joy and pure sadness. They represent true unconditional love. In many ways, they are the most human members of our society. I cannot help but feel that they represent what we hope is best in all of us, the ability to love selflessly and live purely. I don't mean to oversimplify their personalities which are as complex and varied as anyone's, but I do think that we benefit from their presence in our culture and I would hate to see us lose their gifts.

It is probably inevitable that we will treat this condition in the future, and it will be seen as an advance in medicine. I suppose it is, but before we forget their faces, let us not forget the lessons they have to teach us about the potential of the human spirit.

February 06, 2006

Science Stories

I use stories to teach science. As E.O. Wilson wrote, "the universal love of stories is not a coincidence; our brains function by constructing narratives." It is not only how we perceive our world and process information, it is how we learn best and remember what we've learned. I give a copy of his article "The Power of Story" from the American Educator, Spring 2002, to every class I teach.

I happen to be a historical scientist, so teaching through story is easy for me. Every rock tells a story. Every genetic trait tells a story. Every chemical formula tells a story. It is the discovery of the story that fascinates me, and if I can convey this excitement to my students by telling the stories I've learned, I hope to add intrigue to the content I'm teaching.

I also believe that this approach can be utilized as a constructivist format for lessons. I tell my pre-service elementary grade teaching students that they don't have to shy away from teaching a topic just because they don't know every answer their students might ask, to in fact delight in their plight. This is what science is all about, let's find out! Stories inevitably leave room for the imagination. If it were not for the teasing of imagination, science would not grow.

There is nothing wrong with teaching science through stories. Go ahead, try it.

And scientists, and particularly science educators, there is nothing wrong with allowing the creative imagination into science. Science lore has become a new source for allusion and

metaphor in our modern world. Poets and writers and dramatists (including scientists: see today's Cosmic Variance) are appealing to our culture's growing science literacy more and more.

Here is an example of my own, a poem published in Entelechy: Mind and Culture, which seems particularly relevant considering recent events:

Flores Man

Imagine an island
paradise miniature elephants
miniature horses
no thought of an outside
world. You have enjoyed
isolation for so long
you have evolved
small. You have come
to believe
yours is the only
legitimate world.
And then a giant steps
foot off a boat and leaves
footprints in the sand
and you realize
you are not alone.
But instead of feeling
comforted by the knowledge
you are threatened
that the other
will want what you have.
So you build defenses.
And argue about what
to do. Should you seek
out the monster
before it strikes?
Should you reach out
to befriend it? Should you
hide? Should you search
for another island
so far away the giant's
stride won't reach?
And imagine while
you are arguing
that it is yourselves
you being to mistrust.
And factions develop
and wars ensue.

And before the giant
can return to plunder
your island you have laid down
your lives. And your bones
are scattered and buried.
And it takes the giant
so long to find evidence
of your existence
that they exclaim –
Behold! We have found
more Children of God.
Proof that we are not alone.
Imagine that the giant
was also terrified
by this knowledge.

February 06, 2006

Why Be a Scientist?

A number of bloggers have recently cited a study by Jupiter Scientific (SciGuy, Leaves On the Line, Cosmic Variance), that lists the salaries of senior scientists in many fields. The salaries are quite high, which seems to surprise many readers. Each blogger then asks, why can't we use this information to lure more students into science fields? The physical sciences and engineering have seen a fall in the number of students pursuing careers at the same time that opportunities in these fields have increased. Salaries are on the rise because too few US trained scientists and engineers are available to fill them. This trend is expected to grow at frightening speeds in the near future.

So, where are you guys (and gals!)? I have a feeling that it isn't so much that science isn't "fun" in school, but rather that it isn't well defined. What is science, anyway? It is fun early on, isn't it? Then, when you get older it becomes dry and boring? If we are going to keep you guys and gals interested in science, we need to keep it enriching.

I'm trying to help teachers do better. In the meantime, visit your local museums, parks and zoos. Most scientists find their calling through a visit to a museum or zoo, or an experience with the outdoors. It's like anything else. You won't love it until you do it. Go on, get out there and look. Be curious about what science has to offer, and maybe you can cash in on the opportunities in your future.

To find out about science careers, go here (http://hunstem.uhd.edu/CAREERS.html).

To find out about great science programs, go here (http://hunstem.uhd.edu/Programs.html).

Is Black a Color?

A conversation with my son last night brought up a situation in science education that happens to be a pet peeve of mine. My son, who is in the fifth grade stated that black is not a color. Another member of my family disagreed and said, of course it's a color, that's how you make black, you combine all of the colors and you get black.

Of course, both are right, in a sense. My oldest son is scientifically correct to exclude black as a color. Black is the absence of color and an object appearing to be black is black because it absorbs all wavelengths of light and reflects none. No light reaches the retina and we see black in this situation. Practically speaking, however, black is a color. It's in our crayon boxes. You do make it by combining other colors on a page of artwork.

My point is this, quibbling about this can be counter-productive to the teaching of science. Black is the absence of color on our T.V. screen, but the combination of all of the colors in our crayon boxes.

To dogmatically teach kids that black is the absence of color without qualification of how we perceive color is potentially confusing and pompous. Subtle differences in science are often instructive. We should never teach them in such a way that we deny observation and common sense.

It's like saying hot air doesn't rise. Of course it does. We see it rise, it's a common experience and therefore common sense. To tell kids it doesn't rise without qualification is telling them that science is an arcane practice beyond the scope of normal human abilities. Explaining that the hot air is actually being pushed out of the way by sinking colder air is instructive in collaboration with the initial observation, NOT in opposition to it.

I could go on and on with situations in which too many teachers proclaim some arcane truism about science which only obscures the lesson rather than enlightening the student. Equal and opposite forces, simple machines, the 7 properties of minerals, even the five kingdoms (or is it six now, or four?).

In fact, every time I see a numbered list assigned to a concept, it makes my blood boil. We are obscuring the real lessons and teaching them out of context whenever we reduce the lesson to a list of rules.

Use the confusion as the lesson! Why do we need to classify plants and animals into groups? Why is it hard to do so? How do you identify minerals? Why is it helpful to look at specific characteristics to do so? How can we make work easier using machines? How can we make new machines from simpler ones?

Doesn't this sound like inquiry? Isn't that how we should be teaching? Inquiry resolves confusion, it doesn't create it. Dogmatic pronouncements about rules confuse students, they don't make the teacher an expert.

Relax, you don't have to be the expert. Be confused along with your students, and figure it out with them. Use the elucidation of common sense approach rather than the "I know a secret approach." It will make learning science more fun for your students, and teaching science more fun and less stressful for you.

February 27, 2006

ISE and Minorities in Science

I had an interesting week last week. I attended the Informal Science Education Association of Texas (ISEA) meeting in Junction, Texas from Wednesday through Thursday, then traveled to Austin, Texas for the DoD African American Heritage Observance and HBCU Symposium.

As you might imagine, the experiences and perspectives of mostly rural, small museum educators and mostly urban historically black college and university faculty, differ when it comes to the needs of K-12 education.

They do not differ due to agenda, but rather focus. I found much more commonality then one might expect, however. Both groups want to strengthen STEM education for minority students, and both groups are concerned about the effects of standardized testing.

I have already stated in previous blogs that I think standardized testing is antithetical to science education. Whoever you ask and whatever standards you look at, most science educators agree that conceptual learning is more important than the memorization of facts. TEKS (Texas Essential Knowledge and Skills) strands emphasize this, but TAKS (Texas Assessment of Knowledge and Skills) tests obscure this goal by focusing teachers on specific content knowledge, for instance.

The biases of standardized tests are also well documented in minority communities. It is simply impossible to create one test which can effectively measure achievement in all populations from rural to urban, wealthy to poor, east to west, and so on and so on.

I have also argued in earlier blogs that disparities in access to ISE experiences creates a stark variation in the preparedness of students entering preK and K classes. I would propose that addressing this disconnect is part of the solution to the needs of both groups I met with last week.

Kids need exposure to informal science prior to entering classrooms for many reasons. These experiences allow kids to create a framework for understanding and learning. It allows them confidence that they can create their own understanding, and that they are capable of learning science. It demystifies science and makes it seem accessible and relevant. Most importantly, children who are exposed to ISE early in their childhood are stimulated to learn about worlds outside of their own.

This is not an easy solution. How do we increase access to ISE institutions? How do we increase access to parks and outdoor areas? How do we provide the resources necessary for preschools and parents to reach these experiences?

I propose some ideas. First, let's recognize the value of these experiences. Let's tell our elected officials that we want more real experiences for our kids, not more tests. Second, let's organize our resources more effectively. Early childhood programs are proven successful, yet they do not receive adequate funding. Let's tell our elected officials to expand early childhood programs, and to reward those that provide ISE experiences for their students. And, thirdly, let's work together to make ISE experiences more available to our communities. We need more buses or mass transit to ISE areas. ISE outreach programs need to focus on the transportation needs of early childhood programs. Transit authorities need to make ISE areas accessible for parents throughout underserved areas.

I know these are not bold ideas, but they do mark a shift in perspective that is counter to our current political agenda. It takes a concerted effort to turn the tide. Let me know what you think we can do, and what other changes need to be made.

March 06, 2006

Science Tricks

Science Tricks — Trick \'trik\ n 1 : scheme to deceive 2 : prank 3 : knack –
trick-ery \-ere\ n – trick-ster \-ster\.

I've spent a lot of time in preschool classrooms doing hands-on science. Science magic, or science tricks are effective with young children, but not because they make science fun, rather because they focus the children on the third meaning of the word trick, knack. The trick to science is, there is no trick! Unlike a magic trick, science can be explained, and it's not arcane, mystical or even difficult. All it requires is careful observation.

Care \'ker\ n 1 : anxiety 2 : watchful attention 3 : supervision.

Careful watchful attention! All of us, even very young children, can understand the world around us if we are helped to observe it with watchful attention. Science is all around us and we are all scientists.

Science is not the lore of information that has been collected through practice of experiment and observation. It is the process of discovery. Teaching science to children shouldn't be so concerned with the proper language of the teaching as to lose sight of the real lesson — discovery! Teachers can model science best by discovering right along with their students.

And, explanations don't have to be precise. There are many levels of explanation for any phenomenon that are true and appropriate. Children learn best when their own instincts and

observations about their world are shown to fit within a schema, not replaced by "correct" explanations.

Even though I am arguing for discovery teaching over content drill, I don't mean to imply that the content is not important. Wow! Gee Whiz! Science serves little purpose other than kindling fascination. Without correct information Science magic lessons are just as likely to produce misconceptions as to avoid them. But, process-based learning, learning by doing, directed by a competent teacher, allows students to avoid misconceptions and produces science literacy by enabling students to gain confidence in science as well as having fun.

March 21, 2006

Comparing Science Education to Science

It occurred to me, after writing my last entry, that one might confuse the "rigorous" standards of scientific inquiry with the justification for "rigorous" standards for science education. I'd like to use a metaphor to dispel this misconception. The metaphor is the scientific method.

As most people describe it, the scientific method is comprised of 1) the presentation of a problem, 2) the gathering of data and information about the problem and attempted solutions, 3) the formulation of a hypothesis for providing a solution to the problem, 4) the design of controlled experiments to reliably determine the validity of the hypothesis, 5) an analysis of results, and 6) an explanation of conclusions, both positive and negative, with a discussion of what can be done next to further elucidate the problem.

Science advances through rigorous scrutiny of each of these steps through discourse and repetition.

Science does not rely on scores or statistics to evaluate the success of experiments. Though statistics are usually provided to show results and argue for explanatory value, the statistics are not proof of the success of the experiment, but rather one of the many bones of contention that must be scrutinized before a consensus on the explanatory value can be reached.

Science Education, if done well, might also include each of the steps outlined above, particularly at the secondary level, but sadly and often only utilizes the first two steps, primarily the gathering of data and information. The assessment of this step can be tested for. An assessment of any attempts to go beyond this rudimentary step requires the same process as true science, discourse and scrutiny leading to consensus.

I've been in plenty of arguments about what we mean by "science literacy" and I'm not interested in arguing about semantics. I'm interested in higher level thinking skills that are utilized by scientists to define problems and solutions and evaluate results. The same skills everyone needs to deal with issues effected by or resulting from science knowledge and/or process.

The research that I have scrutinized and reached consensus on with colleagues supports inquiry and constructivism. In other words, teaching science as science is done. Hands-on, minds-on, project-based, inquiry driven teaching. This consensus is the result of scrutiny and discourse over the past 90 years since John Dewey introduced the concept of constructivism.

If you don't believe me, check out these resources (http://hunstem.uhd.edu/CONSTRUCT.html).

March 21, 2006

Inquiry vs. Direct Instruction

The concept of Direct Instruction has come up in two recent meetings I've attended. Most prominently in a meeting at the UT Dana Center to discuss quality math and science teaching, where the Director of the Dana Center, Dr. Philip Uri Treisman, refuted a report from the Fordham Institute which gave the TEKS a grade of F.

The Fordham institute gave the TEKS an F because they are vague and unfocused. The TEKS, just as the National Science Standards and the Benchmarks for Science Education, are inquiry based, emphasizing constructivism as the best pedagogy for achieving science literacy. The Fordham Institute describes a constructivist approach as "absurd and dysfunctional" and supports a more rote style of instruction.

You can also read Dr. Treisman's response to the report in the latest issue of The STATellite, the official newsletter of the Science Teachers Association of Texas.

The topic came up again during a presentation at the Southwest-Association for Science Teacher Education. Dr. Carolyn Schroeder presented a meta-analysis of what teaching strategies have been shown to improve student achievement in science. The topic of direct instruction was raised during this talk due to the criticism of educational research in a report to the Department of Education by the Coalition for Evidence-Based Policy.

The report outlines criteria for research that makes it virtually impossible to evaluate teaching strategies such as inquiry. It thus concludes that only direct instruction is shown to be effective. Dr. Schroder's meta-analysis shows the opposite.

This reactionary trend back to rote styles of teaching are disturbing for a number of reasons.

1. This is the same argument that has led us into our current misguided reliance on standardized testing to assess education. The only skills that can be reliably tested for are memorization and the application of formulaic models to solve problems. Higher level thinking skills are impossible to test for because they cannot be tested for through multiple choice tests in any statistically relevent way. The conclusion is, therefore, that rote learning is preferable to conceptual learning because we can point to our success and not have to rely on the intuition of professionals. We have stopped trusting our teachers to evaluate our students. This is erroneous

for a lot of reasons, as well. Teaching quality needs to improve, but the projection of all of our problems in education on teaching is absurd. Teachers need more resources and support, such as smaller class size, more pay, better social services in poor communities, etc. These resources are being taken away at the same time our teachers are being held to irrelevent standards.

2. The only real evidence to support the efficacy of direct instruction is in situations where tutoring is needed to overcome environmental barriers to student success, such as in poor urban preschools. There is no cognitive basis for direct instruction. Cognitive research supports inquiry, that's why this approach is emphasized in the Benchmarks for Education, The National Science Standards and the TEKS. To take this limited research and project it onto a broader perspective is misguided.

3. This misguided strategy appears to be intentional and politically motivated. The Fordham Institute's mission is to encourage "higher standards" through rigorous assessment, and more "choice" in schools. The Coalition for Evidence-Based Policy also calls for "rigorous" assessment. These are becoming buzzwords, not just for support of direct instruction, but for attacks on inquiry and constructivism.

4. The research for the success of inquiry and constructivism is convincing. For starters, check out How People Learn from the National Research Council.

I've discussed this to some extent with Chris Lehman at Practical Theory, and others in the field of Science Education. Our concensus is that constructivism and inquiry are the best tools for teaching science. The Dana Center supports this concesus, as do most associations for science teaching.

The arguments for direct instruction are legitimate in themselves, in the correct context and as part of a healthy debate, but it is disheartening to see these arguments being used to undermine the consensus of education professionals through politcally motivated rhetoric.

Let's keep the debate honest.

March 27, 2006

Do We Need More Scientists and Engineers?

Do we have a shortage of scientists and engineers? If not now, will we soon? Why, if we have such an outcry from government and industry about the need to train more scientists and engineers are so many qualified scientists still languishing in prolonged postdocs?

The answer to these questions are sort of like the answers to predictions about climate change.

Yes, the models predict a precipitous drop in the number of scientists and engineers in the near future, due to attrition and declining numbers of students majoring in STEM fields. I've talked to

presidents of energy companies, and they are truly concerned about the lack of geoscience majors and engineers in the pipeline. I've heard presidents of aeronautics companies claim that they could hire every single engineer graduating from every college in the U.S. and still not fill their needs. I've even seen projections that academia will soon face a huge need for new assistant professors.

So, where're the opportunities right now?

The geosciences are desperate for people, right now.

Engineering is desperate for people, right now.

Academia is not desperate, yet.

Nor are many biomedical fields, or pure research fields, yet.

Will there be a greater demand in the future, and if so, when? This is where I think the job market is a lot like climate change. There will certainly be a need, but exactly where and to what extent is almost impossible to say with true certainty. There will be areas where there will still be a glut of people entering the field, and even some areas where there will be a decline in demand for new people. There will, however, be other areas where the demand will outstrip the supply.

Two factors will play out to determine how this demand for more scientists and engineers will play out. We are not currently seeing a huge increase in salaries offered to new graduates since there are enough foreign born scientists and engineers to fill available spots. This situation may eventually equalize as other countries offer competitive incentives, and as the number of positions in other countries increase. We may see some areas of STEM offering more incentives to students from the U.S., including higher salaries, more scholarships and internships, and even more cash incentives offered to students in High Schools to pursue STEM careers.

These ideas are starting to play out in many state legislatures due to lobbying from industry. President Bush's recent call for more money to train chemists and engineers came from industry persuasion. The next industry demand may be for geoscientists. While everyone has been jumping on the biotech and biomedical career bandwagon due to such exciting advances as the Human Genome Project, the need for advances in energy research and development has grown while the number of students in these fields has plummeted.

Industry leaders are not always quick to respond to shifting workforce needs, but once they do respond, they have resources to offer. Keep your eyes open for programs that will offer incentives to students taking STEM classes at the high school level. I'm not generally a fan of tracking, due to its inherent biases, but the move towards tracking students into STEM courses in underway. We need to be ready so that it does not discriminate against urban and minority students. No one is planning for discrimination, but until the playing field is equalized in early grades, any meritocratic system of tracking in upper grades will be institutionally biased.

So what do I recommend? Students, take MATH! There is nothing that prepares you better for varied career choices!! Teachers, teach through INQUIRY! Students who can solve problems using higher level thinking skills will be the ones to take advantage of the coming opportunities.

Seems simple, but it's not. Mixed messages in our laws and policies will make it hard for teachers to focus on student's futures rather than testing. I'll be out there fighting the fight, and there are a lot of great teachers to lead the way. The future can be bright, if we stay focused.

For more perspectives check out these articles:

RAND Position Paper
(http://www.rand.org/pubs/issue_papers/2005/IP241)
Sloan Foundation Report by Michael Teitelbaum
(http://www.sloan.org/programs/documents/PublicInterestTeitelbaum2003.pdf)
Washington Post article
(http://www.washingtonpost.com/wp-dyn/content/article/2006/02/21/AR2006022101166.html)

For more info on job trends in science, check these out:

American Institute of Physics
(http://www.aip.org/statistics/trends/emptrends.html)
American Chemical Society
(http://www.chemistry.org/portal/a/c/s/1/career.html)?DOC=careers\index.html)
Earth Science World
(http://www.earthsciencecareers.org/careers/links/index.html)
Science Magazine on Bioscience Careers
(http://www.sciencemag.org/cgi/content/full/294/5550/2293?iijkey=XSPM3bY01vxeY&keytype=ref&siteid=sci)
Industrial Chemistry
(http://www.chemistry.org/portal/a/c/s/1/feature_acs.html?id=c373e9f8d9519b198f6a4fd8fe800100)
CareerJournal.com
(http://www.chemistry.org/portal/a/c/s/1/career.html?DOC=carreers\index.html)

March 29, 2006

NCLB Dissent

There is growing dissent with NCLB (No Child Left Behind), and I think it is time to gauge just how big this trend is getting.

I've discussed what I think the fallacies are with testing and direct instruction and other components of NCLB in previous blogs. So have these guys:

Chris Lehman at Practical Theory.
Will Richardson at Weblogg-Ed.
Alan November and Will at November Learning.
Doug Noon at Borderland.
Miguel Guhlin at Mousing Around.

I know there are more people out there who are also concerned. I've talked to teachers and educators of teachers, and most of the people I talk to seem to agree with us. I'd like to know how many of us are out there.

Please respond to this entry and let me know. It can be as simple as Yea, Nay, or you can expound all you like. Just keep it civil. And, no, I don't mind if you disagree. I just want to have an honest discussion and not one filled with rhetoric.

I'll pass your votes and ideas on to other bloggers and colleagues, so let us know what you think.

We need to become a unified voice to be a stronger voice.

April 11, 2006

Women in Science

Why are there fewer women in science than there should be in a society with slightly more women than men in the population? Why do so many women drop out of science careers, even when they are interested in science when entering college? This discussion has been ongoing at LabLit for quite awhile, and there are some interesting ideas. Here're my two cents worth (slightly altered from my original posts at LabLit).

When I was a graduate student I watched as my major professor and others routinely belittled women graduate students and assigned them to stereotyped tasks and projects. It was subtle and unintentional, but this is what makes institutional bias so difficult to overcome. I now work with numerous female scientists, some in research, some not. These women are clearly equally capable to men in their fields, but there is no doubt they approach their roles differently. They seem to be more deferential to other views than most men. This is a good thing, since it raises the "gentleman's agreement" of scientific discourse to a higher standard than the traditional confrontational one.

It is also obvious that many women choose more creative career paths than the traditional series of postdocs. This often removes them from research positions and places them in more administrative ones. I'm not sure if this is due to the disruption of their careers by family demands or if the belittling they experience effects either their confidence or willingness to perservere.

The slow progress towards equity is very frustrating, but I'm hopeful that we will eventually see progress.

I'm a man, but I might have an unusual perspective. Between completing my PhD and working full time in academia, I stayed home with my children for nine years. This choice led me into science education, and though my PhD is in ecology and evolutionary biology, my position is science educator. I am in a science department, however, and I do some field research.

As a man who stayed home for nine years right after finishing a Ph.D. I am now thrilled to be in a situation that allows me to do any research at all. I did not expect to be able to return to academia. I did not experience any discriminatory comments or treatment during my interview, in fact my experience may have uniquely qualified me for my position. My position is a hybrid one, science education in a science department, and it is at an institution low on the research totem pole, but the experience of returning after concentrating on family has been interesting in many ways.

One, it brought me to a "teaching" university serving an "underserved" community of learners. We provide undergraduate research opportunities through our Scholars Academy, primarily to women and minorities. We are beginning to be successful at placing them into professional programs and graduate schools. I've taught at numerous colleges and universities including highly competitive ones, rural ones and urban ones. The students here at UHD are by and large the most mature and hard working I've encountered, and they are equally intelligent as students elsewhere. They still face more barriers to success than traditional college students, but they are courageous and determined.

I think these are the students who will begin to make a difference in the workforce as their numbers grow (not just ours, but at a number of urban universities). They are not naive, they expect hardships, and they may be willing to persevere.

Second, the faculty in our department are mostly women, though it is close to 50/50. The common thread for most of us is that we are second incomes to our spouses. This explains why we are all at a tier 4 university, but our department is growing, and the women here are top notch scientists who may now have a chance to do research they would not have been able to do without a university like ours. I think as their success grows, so will some of the culture.

I think that flexibility will be a bigger issue in all institutions as they have to deal with attrition over the next few decades, and hopefully, this will encourage a better environment for women.

Progress has been too slow, but maybe there is more hope on the horizon.

April 12, 2006

NCLB is Oppressive

I got home in time yesterday to watch The Oprah Winfrey Show with my wife before returning to teach my evening class. Oprah had pieces of an interview with Bill Gates concerning disparities between urban and suburban schools. She then went on to show examples of these disparities in Chicago schools.

The Bill and Melinda Gates Foundation is calling for a complete redesign of our national education policy to combat drop-out rates and the consequences of the biased and negative tracking of students. They share the concern of many when thinking about our future workforce needs against the failures of our education system.

What kept flashing through my mind while watching this show was how complicit NCLB is in these problems. NCLB has exacerbated problems rather than addressing them by creating a system of tracking based on biased measures of success.

Here's something everyone should read: Jim Horn at Schools Matter has written about how NCLB has undermined education rather than improving it. He lists 20 reasons to eliminate NCLB.

Please give special attention and consideration to numbers 6 and 7.

The dangers of tracking have been well documented, but current policies condone the most hideous tracking of all, tracking of urban schools into different curricula because of lower expectations, all while championing testing as a means to overcome the "bigotry of low expectations". Why isn't the hypocrisy of this rhetoric obvious?

The problem with tracking is that it destroys motivation. The current tracking of students into different curricula tells the students in urban schools that they don't matter. This starts very early in their lives, and continues through high school. Dilapidated schools, watered down curricula, belittling of teachers, and unmitigated reliance on standardized test scores to determine success or failure can't possibly produce equity. This is a recipe for bias and failure, and that is called oppression.

NCLB is oppressive. There's no other way to say it. We need to call it what it is, and we need to call an end to NCLB.

April 17, 2006

NCLB Is a Racist Agenda

In my last blog I claimed that NCLB is oppressive. I've been called to task before by using words like oppressive and racist in describing NCLB, but I do not apologize. We are too often too diplomatic in our attempts to highlight the dangers of NCLB while also trying to build something better. In order to clarify some of my points, I'm reprinting an edited version of my contribution to a discussion I participated in at Practical Theory.

I believe that NCLB's spin on education plays on racist fears and insecurities as well as the traditional "kids these days" mentality, but the fact that it has been so successful in the public forum is what troubles me most.

I'm also afraid we've become too comfortable with the idea that racism is in our past. I'm not talking overt racism, but rather institutional. And I am sure that we could debate the definition of this term, but to me institutional racism exists without any individual intention. I believe that traditional practices and cronyism are more powerful discriminatory barriers than we are generally willing to acknowledge.

The current political climate capitalizes on the feelings within middle class white communities that affirmative action policies have gone too far. There is a reactionary mind-set in our culture that is commonly justified by the argument that nobody is really racist any more, and that we need to get beyond arguments of race and focus on equal access. While this is correct in theory, in practice it obscures the institutional barriers to equality still in place. Meritocracy is a sound argument only within a context of equal access and equal advantage. I don't believe we are there yet, though current political agendas argue that we are.

Perhaps the word "racism" is too strong given historical connotations of the term, but what other word should we use? We run the risk of turning people off by using it, but we also run the risk of lulling people to sleep if we don't. What other term can we use to shine a bright enough light on this problem while allowing us a fresh platform for the arguments?

I'm also afraid that no matter how much we want to bash current political education agendas, the bottom line falls on the public. Reframing the question, "why doesn't the public demand change?" "Why isn't NCLB's agenda obvious to the public?" If the public were clamoring for it, political parties would respond.

Those of us who know that testing is antithetical to quality education cannot be heard over the clamor for "accountability". My hope is that the current campaign is the last gasp of a waning hegemony, and that demographic trends will eventually overcome this. But then, I worry about the settler's effect, too.

And to answer the question of how we evaluate quality education without standardized tests, we trust professionals, as we do in most other endeavors. Auditors of companies and universities don't rely on periodic snapshots, they rely on an evaluation of results over a span of time. Ideally,

we should be able to trust in the results our teachers report without needing standardized tests, which cannot practically provide data consistent across a diverse educational landscape.

My main area of concern is science education. Part of the problem with standardized testing in science is the nature of science, and what we mean by science literacy. It is antithetical to teach concept strands that build higher level thinking skills, but test for rote memorization which may or may not indicate understanding. The argument that there is such a thing as an objective standardized test for science literacy is absurd.

Another part of the problem is impatience. We want to know how each student is doing at each step of their education. We used to rely on teachers to tell us, but now we can't because they are generally overburdened by class size or incompetence. I hate to say it, but this testing craze has more to do with our lack of trust in teachers than it does with student's needs.

I am not saying that we should not have standards. Standards are important, and should be administered evenly across the country. What is impossible is to evaluate performance relative to these standards by means of intrinsically flawed tests. Using tests as a means to improve teaching is like trickle-down economics.

We need to be improving student performance by improving teacher quality. This is a slow process, and any real evaluation of progress will have to be made by looking at results.

I agree with Chris Lehmann's assessment that NCLB is designed to "break public education". I think a major part of this process is focusing attention on performance within schools from the lack of support provided to them. The ultimate solution to all of these problems is to elevate teaching to a more valued endeavor and not only pay teachers accordingly, but provide the support they need.

Imagine if our schools were a corporation deriving profits from a percentage of their students future earnings (ignore the obvious inequities in structuring education this way, and keep this quiet from the neoconservatives, they may actually want to try this, with loopholes for the wealthy, of course). A corporation would recognize that the engine of their profits, in this scenario, are its teachers. Such a corporation would provide support for these teachers as well as paying competitively for teacher's services. We would see more teachers with smaller class sizes and more technical support.

How do we achieve this within our current culture, and still maintain the egalitarian ideals of public education which sets it apart from other educational systems in the world? If anyone has the answer to this question, they deserve a Nobel Prize. In the meantime, we continue to work to help one teacher at a time, one student at a time, one voter at a time; and we hope that a groundswell emerges that can turn the current tide of destructive policy.

We need a stronger voice of opposition within the education community. The public will heed our call if they believe it is coming from the teachers themselves. This means we have to convince teachers of the benefits of teaching, too. Many of them are too cowed by the specter of

declining education presented by those clamoring for accountability to feel emboldened enough to fight back.

It is a two front battle, from within and without, but it is a battle we can win.

April 24, 2006

Integrated PBL Works Wonders

Enough diatribes against NCLB, for now anyway. I'd really rather champion what is effective, rather than screaming into the wind (I may be banging my head against a wall either way, but at least trying to make a difference feels better).

Within the circle of educators of teachers of science, constructivism and inquiry applied through hands-on projects-based learning, is the most effective way to teach science. Constructivism is an effective strategy for improving science literacy in the classroom. It makes science relevant, accessible, and engaging for students.

It has not, however, become the revolution that could be expected. The reason for this is the slow incorporation of constructivist strategies into actual teacher practice. What is needed is to incorporate the constructivist strategy into pre-service teacher education.

There are a growing number of programs that do incorporate this strategy into their pre-service science content courses. One of the repercussions of this strategy, however, is decreased classroom time to cover content information. At the University of Houston – Downtown, The Natural Science Department and The Center for Urban Education have worked together to develop a combined physical science and earth science content course to be taught alongside a life science content course for completion of science requirements. The challenge is making this course effective. Constructivist teaching method already puts a lot of pressure on content coverage. How can we double the content load and increase learning?

What we found, is that students learn concepts better in the combined approach compared to being taught each content area separately. Though our population is small, by comparing test results of students in the combined course to results of students in the previous separate courses, it can be shown that the students in the combined course have a deeper understanding of key concepts.

We believe this is due to the increase in the relevance of the material for these students when concepts are related across disciplines, reflecting the same benefits of constructivism for their students.

Integrating math and science is a must, but integrating science content into other subjects, or vice versa, is also effective. Literature, art, social studies, history, even physical education can be

integrated with science. If teachers of these different areas work together, then we can redefine instruction, and save ourselves from NCLB.

Oh snap, I said I wouldn't go there.

April 27, 2006

Why We Can't Blame Teachers

I teach college level courses, and I give almost entirely essay type exams. I tell my students that there is no single correct answer, but that there are key concepts that must be understood. I usually allow them to use whatever notes or other resources they want to bring with them, but of course I warn them not to expect to find the answers in one place, and that if they are not prepared they will not be able to finish the exam.

I grade answers depending on the content mentioned, the understanding of the concept, but also on the level of personlalization of the answer. In other words, how well they put it in their own words. An answer with elements obviously taken directly from a source is graded much more strictly than one meandering around looking for connections and hitting on some.

I get away with this because I'm a college professor. I have a Ph.D. and I'm trusted to be able to discriminate the quality of answers in a subjective manner.

We used to trust teachers at all levels to do this.

We stopped trusting teachers to use their own judgment when we started noticing test scores going down relative to other countries. I'm generalizing grossly, of course. I don't mean to absolve bad teachers of their mistakes, but we've lost faith in our teachers, and it's for the WRONG reasons.

When we noticed that too many of our students weren't getting the education they need, we looked to the teachers for an explanation. We wrongly blamed them, or rather teacher quality. There are plenty of bad teachers, and it was easy to see a correlation between declining test scores and teacher quality.

What we failed to see was that it wasn't teacher quality that was changing. There have always been bad teachers. What has changed is our social paradigm. Not meaning to champion Bill Gates necessarily, but his words: “America’s high schools are obsolete. Even when working exactly as designed they cannot teach our kids what they need to know in today’s world." are on the mark.

There are plenty of great examples of what needs to be done, and many other great voices behind new paradigms.

Go see what's happening at The Science Leadership Academy, or The Beacon School, for instance.

Read what educators in the trenches, such as Doug at Borderland, the group of contributers at Schools Matter, Bill at Webblog-Ed, Alan at November Learning, or Miguel at Mousing Around have to say.

Go find out about connectivism, or the ideas being proposed by Grace and James Boggs, Scott McNeely at Sun Microsystems, or The New Education Paradigm

There are lots more, and I'll try to find them and bring them to you. I really think their ideas will change the way we see the problem and how we find solutions. I really think we will eventually realize why all of our attempted solutions to date have ultimately been unsatisfactory.

When enough people realize that we need a new paradigm rather than a new group to blame, then we will begin to see real results, for every student.

May 08, 2006

Bone of Contention

One of my favorite cartoons:

I have a bone of contention. Why is every word chosen to represent an idea automatically treated as a label? Why do we argue semantics over different perspectives on certain words? Particularly when we agree more than we disagree, why do we spend so much time arguing over minor details?

Here are a few examples:

Science literacy - Is science literacy "basic facts" that the scientifically literate should know (Raymo 1998, Trefil 1996)", a list of "behaviors that serve as guidelines for interpreting the functions of science/technology (DeHart Hurd 1998)", "successful information seeking behavior" (Sapp 1992), "scientific awareness" (Devlin 1998), or "scientific ways of knowing" (Maienschein 1999)?

Are you kidding me? Why is it this so hard? Science literacy is the ability to solve problems by comparing results against a known (controlled) scenario. That's what we do, as scientists. It's what anyone trying to figure out an allergy tries to do, or anyone trying to decipher public information on an issue before voting.

Go ahead, wiggle this definition all you want. You can't change the basic definition by citing variations of this process and claiming uniqueness. The strength of the definition is in its flexibility.

In education, we should encourage ANY teaching that promotes higher level thinking skills. The skills are what make literacy. You are not literate in English due to vocabulary. You are literate due to comprehension. The same is true for Computer programming. You can define parts of the computer all you want, but you aren't literate unless you can write code that works. You can know all of the definitions of science you want, but you are not literate unless you can apply your knowledge to solve NEW problems.

As a college professor, I would much rather have a student who can think over one who knows a lot. I can teach the content, if the student can understand the concepts that place the content into an explanatory framework. Without the ability to understand the concept, no amount of hammering away at content will ever succeed.

Is this so haaard? Let's relax on the debate over semantics. We agree on most of this. Let's look for points of agreement that we can work on constructively rather than for how we differ.

Constructivism - Constructivism says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. It is a metacognitive strategy. We can debate the research. I can cite evidence of success, and others can cite evidence of failure. The application of constructivism runs the gamut from unguided field trips to strict PBL. The basic idea is pretty simple, and it doesn't have to be complicated.

Again, I would like to emphasize that ANY curriculum that allows a child to form their understanding of a topic from their own EXPERIENCE is constructivism. This is good. A lesson doesn't have to be completely hands-on. It doesn't have to be unguided, at all. Children will NOT learn, however, if they don't formulate their own understanding.

You cannot have **Science Literacy** without **Constructivism**

Go ahead, challenge me on that one. I'd love to discuss this further.

But first, one last nit to pick. **Inquiry** - It's good to ask questions. Any time a student is asked a question they have to think. You can't guide constructivism without inquiry. You can't achieve science literacy without inquiry. Inquiry is asking questions. Let's keep it that simple. Ask a question to start a lesson. Ask a question to guide a lesson. Ask a question to assess understanding. Ask a question to close a lesson. I don't care where you ask the question. Ask questions.

Inquiry emphasizes that we don't know everything. It emphasizes that we should be curious. It emphasizes our need to seek out answers. Inquiry is how we should live our lives. Every day. For the rest of our lives.

"Any intelligent fool can make things bigger, more complex, and more violent. It takes a touch of genius—and a lot of courage—to move in the opposite direction." - E. F. Schumacker

"Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity." - Charles Mingus

"Everything should be made as simple as possible, but not simpler." - Albert Einstein

technorati tag: teaching-carnival

May 16, 2006

Devil's Advocate

Here're some ideas I offer up for discussion.

What can we do to "fix" our current K-12 educational system?

For starters, let's start from scratch.

What if there was no public education? Too many children are falling by the wayside. Our society is dangerously polarized. We are falling farther and farther behind the rest of the world, and our economy is teetering on the edge. For the sake of our future, we must educate all children in this country. How do we do it?

OK

Let's make our public education system democratic. Let's involve the entire community. Let's utilize all community resources: schools, libraries, informal science centers, parks, civic and professional groups.

Let's provide resources to preschool education as early as two years old. School attendance need not be mandatory till Kindergarten, but school should be available to ALL starting at the age of two.

School duty should be as mandatory as jury duty. As a sense of public pride, let's ALL commit to serving a certain number of hours, perhaps 20/year/person, to provide tutoring and other services to schools. There can be reasons to disqualify someone from school duty, or to allow someone to avoid it, but we'll work out the details later.

Let's remove the mandatory requirement to go to High School. Let's be realistic. If we lived up to our 8th grade standards, our children could work as soon as they turn 16. Why do we continue to require them to go to school if they don't want to? Let's let them decide. Let's let them find out how valuable education is. Let's have an open-door policy on our high schools. We should continue to provide a solid, college-prep curriculum for ALL students. We should provide this resource in the evenings and weekends as well as during the work day. Students should be able to enroll in High School at any age and follow the required curriculum on their time, with a limit on how long they can take to finish, but flexible.

Then, we MUST live up to our 8th grade standards.

And, let's integrate all subjects, as much as possible.

Let's use ALL appropriate methods of instruction and stop trying to fit our curricula into neat little boxes. We must use constructivism, inquiry, direct instruction and problem-based, project-based learning WHENEVER appropriate. Within and across lessons.

And, let's let the teachers decide. Every classroom doesn't have to be identical. That's NOT what democracy is all about.

But, every student should have access to the same resources and the same quality of teachers who are capable of designing a curriculum and assessing student's progress.

Every teacher should have a major in their field and a minor in education. Perhaps teacher education should take five years, like a CPA, engineer, or pharmacist.

Let's acknowledge that pedagogy nor content knowledge alone guarantee a good teacher. Teaching is a talent that can be developed like any other, but some people just aren't cut out to be teachers, no matter how smart, and others are just naturals and don't really need that much course work.

Let's provide professional development that works.

Let's make assessment transparent (more on this one in my next blog). For teachers, teachers of teachers, and students.

Let's acknowledge that the whole student must be educated, mind, body and spirit. Let's include music and art at every grade level. Let's allow every kid to participate in athletics at their own level.

Competitive sports should be pursued off-campus. All school coaches should be volunteers.

Have I left anything out? I'm sure I have.

How about safety? Nutrition? Length of the day? After school community involvement? Length of the year? Summer opportunities for students? Parental support systems? Parental requirements? Teacher salaries?

You should also read John Gatto's 1990 acceptance speech for teacher of the year in New York City at Robin Goode. It makes you think, doesn't it? And thanks again, to Doug Noon for the reference.

I particularly like how he calls for community involvement and democracy.

And, I missed the point about community service for students. That's a great idea!

So, provocative enough? Let's talk about it!

May 19, 2006

From My Soap Box

I'm going out of town next week, so I'm writing my blog today. I just came back from my preschooler's graduation, but while we were waiting, I had many interesting conversations with other parents who have kids the same age as our oldest child, in 5th grade. We were bemoaning an especially bad teacher they had for math, and how much damage she has probably caused through her laziness, and of course, education reform came up. I'm really not going to go into much detail about these conversations, but I found myself returning to a rant in my mind on my commute back to work after my daughter's event.

If there is ONE thing that can improve a number of problems, this is it. Provide EARLY childhood education. I advocated providing preschool for every child, at least twice a week, in my last post, but I wasn't strong enough. We need to provide transportation, nutrition, instruction, socialization, but most of all, we need to foster exploration and expanded real experiences for young children.

The myth that seems to exist, that every five year old entering Kindergarten is starting out on equal footing is ABSURD. The expectation that a 5 yr old in a classroom, recognizing how far behind they already are, will somehow muster the resources to buckle down and catch up rather that give up, is insanely callous. The attempt to solve this problem by putting higher expectations on these kids as they matriculate is perhaps well-intentioned, if you don't know any better, but wildly ignorant fantasy.

Sure, some will actually do it, regardless of their obstacles, but these are the kids far from the mean of resiliency. The bottom line is, that to expect all kids in this situation to succeed by higher expectations alone is unrealistic.

High expectations are absolutely needed, and are part of the solution, but not a means to an end in themselves.

There is another myth that too many people have. The idea that there was ever a "good old days" of education, somewhere post-Sputnik, when every child was being properly educated. The disparities between schools for the wealthy and middle class and schools for our poor have always existed. We just ignored the poor before integration. Now we're more honest with our desire to educate EVERY child, but where do we get the idea that we ever have?

You can still go to most suburban school districts and find greater resources than are available to urban districts. You will find more highly qualified teachers and better performing students. You have to be sociopathic to really argue with me that there is equality in our schools and all we need to do is toughen the standards in urban schools to bring them up to the level of the richer districts.

I'll use my children as examples. By the time my children entered Kindergarten, they had seen petroglyphs and lava fields in New Mexico, three different beaches, marshes and forests, mountains and deserts, zoos and nature centers in five states, numerous museums and theme parks. They have all gone on walks with me where we've discussed nature and weather and space and natural history. They've learned French and history and music and from my wife. They've played educational computer games. They've been read to and listened to.

I'm not bragging. This is a fairly typical experience for most middle income families with educated parents who have the resources and time to spend with their kids.

Now let's think about a poor child. Both parents work. They are placed in daycare, not a Mothers-day-out program or preschool where they get hands-on instructional activities. They probably have not traveled beyond their neighborhoods. They don't get to go to the zoo, and museums and theme parks. Their parents value education and tell their kids that education is the key to their future, but they don't have time to read to them very often. They have no computer.

They live in a stable environment. I'm not talking about the more chaotic environment most people use to stereotype poor urban areas. And, this isn't at all about race. I grew up in Appalachia and my mother was a social worker. I've seen poverty across the board. The results are the same. It isn't about urban and rural. It's about money.

Now, take these two children and put them in the same classroom. Start teaching. The child with limited experiences before this point will easily recognize the disparity. This kid isn't stupid, he or she knows right away that they are at a disadvantage. But, this is a five year old!! How do you think this child will internalize this experience. Will he or she say, well damn, I haven't had all of the experiences of these other children, but if I buckle down and work hard, I can catch up. Or, will he or she decide, wow, I must be stupid.

THEY"RE FIVE.

And then somehow, when they get to 5th grade or 8th grade or high school and they still think they're stupid, and they still think there's no point in trying because they'll never catch up, we start agreeing with them. They must either be stupid or lazy. We've provided everything they need to succeed. If they haven't taken advantage of their opportunities by now, they're probably hopeless.

We expect a kid who is demoralized at age 5 to recover their self esteem by the time they're 6, or 10, or 14, as they struggle every year to keep up? This is psychological avoidance on our part. Why do you think all of the pop-psyche self-esteem programs fail? It's too late! These kids have gone through years of internalizing these issues.

It makes me crazy that at least a glimmer of this reality is not obvious to everyone. It makes me insane that we keep trying to fix our problems from the top down instead of from the beginning up.

I truly can't understand why at least some part of what I've just said isn't patently obvious to anyone with enough empathy to care about any child other than their own.

Politics aside, do we really want to solve this problem, or not?

August 14, 2006

Chaos and Education Research

Doug Noon at Borderland has started an interesting discussion on education research in his entryWhen Hell Freezes Over. He is discussing an entry by Stephanie Sandifer at Change Agency titled Data Analysis and the Four C's of Change which offers an interesting and promising paradigm for education research.

Doug warns, however, that even with well designed research paradigms, the fundamental assumptions going in must be understood to draw meaningful conclusions. He cites an article from the NY Times, It Takes More Than Schools to Close Achievement Gap by Diana Jean Schemo to illustrate how many variables may affect student achievement. The discussion becomes, then, just how can we measure student achievement in a meaningful way?

I've entered into this debate before, with rightwingprof at Right Wing Nation, and I believe the argument boils down to this:

Those in favor of using standardized testing to measure the success or failure of schools and curricula believe that the details of cause and effect are obscured by the big picture. They believe that measuring the bottom line is sufficient to provide the knowledge and pressure needed to force changes that will improve results for everyone.

And they are correct in one assumption; we do live in a bottom-line world. Ultimately, all that matters for any student is the ability to compete for jobs. The world is full of inequities, and students must compete and succeed in spite of these inequities.

What I disagree with is that the reality of a harsh world should in itself allow us to disallow treatments of this harsh reality in our solutions.

The other side of this debate holds the following assumptions:

1. While reasons for failure are not excuses, only by understanding the reasons for failure can we affect truly meaningful solutions.

2. Paradigms for education must be found that take social inequities into consideration. (Granted, whereas I agree that this approach too often leads to negative results due to a lowering of expectations, it does not need to. With the discipline to hold all students to the same standards while at the same time recognizing the additional needs of challenged students, we should be able to identify ways to provide the additional help needed to succeed.)

3. Paradigms for education research, therefore, must try to identify causes of differential performance in order to be meaningful. Simply measuring the inequities in results between groups does not provide enough information, and proposed solutions to these inequities based on the assumption that the school or curriculum is the cause of these inequities may be short-sighted if not completely erroneous.

Which brings me to the point of this article, how do we design research paradigms that provide meaningful results in education?

I believe it is **nearly** impossible.

I believe this because I think education is a chaotic system.

What does this mean for education research? Let me try to explain. I'm not an expert in chaos theory, so I may not be able to make a convincing argument, but I am a scientist who studies chaotic systems, and I believe my suspicions concerning education as a chaotic system have some merit.

First, what is a chaotic system? A chaotic system is a non-linear dynamical system. Non-linear means that the sum (results) do not follow in a linear path from the initial parameters (causes). Chaotic systems are deterministic, however, even though results appear to be random. There are real cause and effect relationships going on, but deciphering patterns of effect given limited information is impossible, and measuring all variables involved is impractical.

Michael Lornzen has written an article about Chaos and Education that provides a place to start thinking about chaos' role in education research.

One particular way in which education is chaotic is the affect initial conditions have on eventual outcomes. In a chaotic system, even small differences in initial conditions can have large, seemingly random, impacts on outcomes. Think of the array of initial conditions for students entering the education system and it should become obvious just how difficult it is to expect to effect unified outcomes with a standardized solution.

As a scientist peripherally concerned with climate change and biogeochemistry (both chaotic systems), I know that we can model these systems with some reliability, and we can make some general statements of expectations of the system which are useful in making predictions of future behavior. It is also obvious, however, that we cannot make fine-scale predictions.

For education, I might propose, that while we can say that certain practices are affective in specific situations, we cannot then predict that these solutions will apply to larger populations. We cannot take a successful strategy from one school and automatically impose it on another, and we cannot take any one study and project it to a larger audience.

Research in education is, therefore, like research in my own field of mitigated wetland ecology. I can study a mitigated wetland system in Texas and come to some conclusions about the success of mitigation efforts in my system, but I cannot predict success of similar mitigation efforts in a wetland system in South Carolina. Likewise, I can study the effects of direct instruction on the outcomes of test results in an urban social studies classroom, but I cannot then apply those results to the science classroom next door, or to the social studies classroom in the suburbs.

These are my suspicions, anyway, but I think they help to explain the difficulty in finding meaningful results in education research.

What does this mean for researchers in education? Should we give up? Should we throw everything done previously away and start over?

No, but we MUST always put our results in proper perspective and recognize the limited applicability of our studies. We must continue to study the impact of programs, but we must realize that the results of these studies are most likely only true for the local population studied. We must avoid trying to standardize approaches and results. We must also realize that studies of particular curricula or pedagogical approaches are similarly limited to local environments.

We must always state our conclusions in light of our assumptions, and we must always be humble in our statements of cause and effect.

We CANNOT expect to design a single test that is meaningful for a large diverse population.

What I would like to add is this, since education is a social science, and is most likely chaotic, we must still rely more on teachers in the classroom to tell us what works and what doesn't than on the limited perspective of standardized test results.

August 21, 2006

A New Hypothesis: a Blog in Three Parts

This week's blog is mainly a response to the responses to my last blog, Chaos and Education Research. I'd like to break it down into three parts: IQ and SES, a new hypothesis, and how we should measure school success. This may be lengthy, so here goes.

1. On the issue of IQ and SES, raised by KDeRosa at D-EDRECKONING. He states, " Low IQ causes low achievement. Low achievement causes low SES. It's not the LOW SES causing the low achievement; it's the low IQ." He then refers to a document from the American Psychological Association, "Knowns and Unknowns" which is reported in,The Wall Street Journal. It is not my contention that any of these statements are wrong, and in fact, my arguments rely on them as well. The difference is our focus on causality.

I believe that KDeRosa is working on the assumption that we are at a place in our knowledge of education and learning that we can build our policies and programs from the data, and that this is reliable because the data are not biased.

I agree that there are no "obvious" biases in the data.

I argue, however, that we do not yet know enough to make conclusions from the data. Not enough, anyway, to make reliable policy decisions. Here's why. As a scientist considering the information in the APA's statements, I'm left with two questions. 1. Why does the distribution of IQ scores for all ethnic groups show the same range, with different means due to clustering of scores for different groups (especially since this is a persistent pattern across SES groups)? 2. If IQ is highly heritable, but not immutable, what environmental factors are responsible for the 20% of variability attributed to environment (especially since IQ seems to stabilize during childhood)?

As an evolutionary scientist (I'm a paleobiologist, a hybrid of biology and historical geology), I've come to agree with the assumption that there are no biological differences between races of Homo sapiens. That we measure a difference in IQ is thus an unexpected result. Explanations range from discrediting IQ testing completely to claiming that biologist are wrong and race is a biological distinction not just a sociological one. The first claim is likely at least incomplete (other's argue that the reliability of IQ testing is real, but that predictive value, in other words validity, is misleading) while the second is almost certainly absurd, so what else (I can go into this in another blog if challenged, but there's no space here)? Some have argued historical artifacts of slavery are involved, but I think that is taken into account by the APA's conclusions. Others claim there may be cultural reasons, and I believe there may be, but blaming cultural affects entirely is antithetical to the validity of the test, so if we accept the test's validity we have to look elsewhere for the larger explanation.

Part of our problem in this discussion is the slippery definition of cause and effect. There in no mention of causality in the APA statements, in fact they go out of their way to avoid such conclusions. But, correlations have to be explained as well, and it is usually done by looking for

causes. We don't yet know what causes these differences, but that does not mean that whatever causes there are can be ignored due to the high correlative relationships between IQ and genes and IQ and SES. These correlations tell us that we can predict outcomes for groups reliably, at present, but nothing about what needs to be done to close the gaps.

I believe it is a bit short-sighted to base education policy on the assumption that the affects of low SES can be overcome by "better teaching" or that we know enough about the relationship between IQ and SES to ignore continuing efforts to find causal links. Obviously we must strive for better teaching while we continue to search for other answers, but we aren't to a place yet where we can exclude the effects of SES on outcomes in education.

So, I'm to part 2 of my argument. If we still need to explain why low IQ and low SES are correlated so strongly, and why interventions relating to SES have not been shown to affect educational achievement (or IQ, in the long run), then what are we missing? I admit I'm going to draw on two areas of personal experience to develop my hypothesis, though I do have some evidence behind my thinking as well.

The first piece comes from my experience as a teacher in community colleges and universities around the Houston area. I've taught in rural and urban colleges, open-enrollment and highly selective universities, and formal and informal institutions. I currently work at an open enrollment university in an urban area. My students are predominantly black and Hispanic. I also work within the Scholars Academy at UHD where we bring in students from low SES areas, provide research opportunities and other support, and produce students ready to enter graduate and professional schools. We've been very successful, but I won't go into details here (I'd love to, so if you challenge these statements, just let me know). It is my experience here and at other urban colleges, that the level of effective intelligence is no different from that of the more selective rural colleges. Now this is purely subjective, but I do believe that evaluations of our success through the SA will show that our program is overcoming the differences measured by standardized tests between our students and more affluent students and creating professionals and graduate students performing on an equal basis.

This personal experience leads me to believe that there are interventions that might be more successful, if we could be sufficiently diligent and strident in our intervention efforts. The scattered successes of interventions and successful schools in low SES areas elsewhere also suggest this, but obviously, no single intervention has proven permanent without the quality teachers and administrators responsible for these interventions. Again, we are back to a situation in which the effects of the intervention flattens out across a larger population.

So, I draw on another area of personal experience to find where intervention shows more promise. I have volunteered for the past 18 years for an organization in Houston called Casa De Esperanza. They are an organization that provides temporary foster care for infants and children abandoned or abused until their parents can recover from addiction or illness. Casa started out primarily concerned with HIV positive children, and that is when I became involved. Over the years, Casa has grown to provide help for more children suffering from prenatal exposure to drugs. Casa has also become involved with adoption through long-term foster care, since many of the parents placing children with them are never able to recover.

I have watched children failing to thrive as infants develop into children successful in school. I have seen many of these children enter GT programs. Not all do, but the percentages, given Casa's intervention, are more similar to the national mean than to the expected mean given their SES and prenatal exposure to drugs. I have adopted three of these children, bringing them home at three days old. I have seen each of them struggle with prenatal exposures. Two of them score above the 90th percentile on national tests, while the other is at the mean for his age-level. I don't believe the influence of our home environment is responsible for this. These kids already had it in them.

Now, I don't expect my personal experience to be convincing, but my experiences have led me to explore the research on the effects of prenatal exposure to drugs, and the research shows that the results depend almost entirely on environment, particularly on attachment to a care giver.

As Ira Chasnoff, MD, a University of Illinois College of Medicine researcher, says "Their cognitive development is normal when you control for environmental and other factors." Dr. Chasnoff has been studying children with prenatal cocaine exposure since the early 1980s.

The findings show that if a child exposed to drugs in utero is raised in a stable environment, no measurable cognitive differences are measured. If the child is raised in an unstable environment in which attachment to a care-giver is compromised, the child shows distinct measurable differences in cognitive development. This is occurring during a stage of development in which the brain is still forming.

Attachment is the key.

These conclusions are supported by Child Welfare Information Gateway, The Adoption Institute, many studies (with abstracts) atProject Cork, current theory of child development and learning, and long-term longitudinal studies of child development at UMDNJ.

It seems logical for me to propose that environmental factors affecting IQ in utero, at birth and during early development (first 12 months) are potentially causal and more responsible for differences in IQ between SES groups than currently predicted. Disparities in health and environment for different SES groups cannot be argued. It is not just drug use I'm talking about, but exposure to lead and disease during early childhood for examples. Any environmental factor that disrupts attachment, is potentially intractable.

As the APA document states, "Genetically caused differences are not necessarily irremediable (consider diabetes, poor vision, and phenalketonuria), nor are environmentally caused ones necessarily remediable (consider injuries, poisons, severe neglect, and some diseases). Both may be preventable to some extent."

These causes occur during the attachment phase of a child's development and are extremely difficult to study, but it seems to me that there is enough evidence to suggest that there is explanatory value here.

It also seems fairly foolish to expect studies of interventions beyond this early stage of development and within single generations to be of any value. The damage is already done, and no amount of intervention after this stage can have reliable effects.

The weakness of my hypothesis is the consistency of racial differences in IQ means across SES groups, but there is some support for my argument from the stability of the correlation between low IQ and low SES across racial groups. I do suspect that there are cultural aspects of the differences here, and that elucidation of all factors would require a multiple-generational study. The study I suggest would control for early childhood affects and track effects across at least three generations.

That probably won't happen, but my central point in the blog that led to this one is that these causal relationships are chaotic, and that we are not at a stage where we can rely on research in education for large populations.

This brings me, finally, to my 3rd point. How can we measure the success of schools, then, if standardized tests aren't valid. I'll try to go into this more in the future, but I think the bottom line is that we will also have to look at long-range evaluation methods rather than snapshots. Ultimately, the measure of success must be results: Can a school's graduates get and keep jobs? Can they get into and stay in college? What is the drop-out rate? For example.

Just as there are no quick fixes, there are no snapshot measurements that can give us an accurate comparison of groups. Standardized tests obviously give us some information (data), but the interpretation of this data is far from complete.

We must work locally to improve our schools, and nationally at decreasing discrepancies in resources. We must try to create an even playing field for all schools, while we evaluate local efforts.

Well, I'm sure I've failed to fulfill all of my objectives, but I've got to go pick up my kids from school. I'm sure that there will be plenty of discussion, so I'll leave it here for now. I look forward to any debate my ideas might raise.

Thank you.

August 28, 2006

Katrina's Aftermath on Education

There is an interesting discussion developing at The Houston Chronicle's education blog School Zone, concerning students from New Orleans who have remained in Houston area schools.

New Orleans may serve as a microcosm of the failures of education for the poor in this country, just as it did for our failure to protect the health of the poor. None of the problems New Orleans

schools faced are unique to New Orleans, but they were perhaps magnified. Now the magnifying lens on students returning to school in New Orleans and in cities like Houston will only intensify the debate over what needs to be done to educate the poor, and why we are failing them.

Obviously, this relates to my previous posts concerning chaos and education which got side-tracked into the one about SES and IQ. I stand by my arguments in those posts and I think the arguments are complete. (any of you cowards slapping each other on the back at other blogs involved in this discussion who want to leave a comment here are more than welcome. I'll answer any comments, but I'd rather not spend an inordinate amount of time on it, so please don't argue about minutiae).

What I would rather focus on are solutions, as I know everyone would. We might disagree about what solutions are appropriate or effective, but we all agree that we have failed the poor in this country.

What if we could start over? What would our system look like if we could start from scratch? There are some efforts to do just that through the Recovery School District and the many charter organizations operating in New Orleans.

What would you do if you could build a school from the ground up? It's being done at the Science Leadership Academy as chronicled at Practical Theory. But what if you were challenged to build your school in a poor area with a ravaged infrastructure? What would you do?

I might try some of the things I suggested in my previous post Devil's Advocate, but we'd have to do more. How should we build the new buildings? How should we staff them? How should we administer them? How should we evaluate them?

Here're a few more suggestions to stir the pot:

1. Use specialists at all age levels, not just secondary. Have the specialists move between home rooms, but have elementary math teachers, elementary science teachers, elementary social studies and reading and grammar teachers. Have the home room teacher assist each specialist by maintaining discipline and helping with methodology. They should work as a team to plan the curriculum, and it should be integrated across subjects as much as possible.

2. Have an administrator whose sole duty is evaluation of student success. Have them work with the teams of teachers to develop the curriculum and assessment appropriate for each subject and age level. Let this specialist work with the home room teacher to ensure students are prepared to take standardized tests. Let the specialists teach their subject and evaluate the student's success in their curricula without worrying about the standardized tests (they aren't meant to interfere with the curriculum any way, but to evaluate core requirements).

3. Get out of the school as much as possible. Go places and do things, but make it part of the curriculum, not a "break" from the classroom.

4. Every school should have its own bank, greenhouse, stock market, drama department, museum (fine art and science), and library. These should be student run as much as possible, even at elementary schools. Students should have to learn to manage and make money, organize collections, act, organize a lab, and grow something.

5. And, every parent should attend 20 hrs of in-service each year. Employers in the area should allow this as if it were jury duty or reserve duty.

All right, what do ya'll think?

October 02, 2006

Parent Education

There has been a lot of concern expressed in the Ed blogosphere about the lack of parent involvement with their kid's education, and how difficult it is to teach kids who lack parental supervision. There seems to be increasing attempts to address these issues within school districts, though how effective these efforts will be is yet to be determined. Hopefully, we can find some good paradigms from the attempts.

Here's an article from the Houston Chronicle on parenting classes offered through Cypress-Fairbanks ISD. It was also commented on by the Chronicle's bloggers at School Zone, with some interesting discussion developing.

Here's a quote from the article that should bring a smile to all of the teachers in the trenches who struggle with kids of ineffective parents:

"That class is not to change the kid's behavior. It reshapes the parent behavior, which reshapes the child's behavior," said Lanell Kelley, a counselor at Cypress-Springs High School who has taught parenting classes for the district for 14 years.

Cy-Fair is a respected district in the Houston area, mostly suburban, mostly middle class, with increasing diversity issues. According to Lanell, parenting classes have been ongoing for 14 years, so why is this article "news"? Is it a new program, or a new awareness of the need for outreach from our schools? Is this a sign of renewed commitment to this need, or another ineffective charade?

What do schools need to be teaching parents? How do these needs vary from urban to suburban to rural areas?

How do we get parents to participate? Can we get the parents we really need into classes, or will we only further polarize the problem? How systemic should these efforts become?

These are the questions we need to be asking to avoid having these renewed efforts at educating parents fall into the wasted effort category. Isolated experiments, here and there, are good starting points, but we need to bring this discussion onto a larger stage, and we need to demand more accountability of our legislatures who don't want to face these difficult political quagmires.

October 09, 2006

My Own Model of Constructivism

My personal model of constructivism has developed from my experiences as classroom teacher, museum curator, and content specialist. It is consistent with the Benchmarks for Education, the National Science Education Standards and the TEKS.

My constructivism is inseparable from Inquiry and Project-Based Learning.

I don't like to get hung up on labels, so I'm not trying to provide a definition of constructivism in this post. This is how I apply it. Similarly, the terms inquiry and PBL are well described by the links above, so I'm certainly not trying to define these terms either. I prefer to use them as generalizations and apply them as appropriate.

To borrow from the NRC, **Inquiry as defined in the National Science Education Standards (NRC, 1995)** is

"… a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze and interpret data; proposing answers, explanations and predictions; and communicating the results."

Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.

Students should learn the principles and concepts of science (the big ideas); be able to do science (the procedural skills and mental reasoning abilities needed to carry out an investigation); and understand the nature of science as a human activity, a way of constructing knowledge.

Students should be able to identify questions and concepts for identification, design and conduct investigations, use technology and math to aid an investigation, formulate explanations using logic and evidence, analyze alternative explanations, and communicate and defend an argument.

Students should understand that in science, investigations involve asking a question and comparing the answer to what is known, that explanations emphasize evidence, that explanations have logically consistent arguments, that investigations are repeatable by others, and that scientists make their results public and review and ask each other questions.

Learners should be engaged by scientifically oriented questions. Learners should be able to formulate explanations from evidence to address scientifically oriented questions. Learners should give priority to evidence that allows them to develop and evaluate explanations. Learners should be able to communicate and justify their proposed explanations.

Learners must build new knowledge and understanding based on what they already know and believe, their "prior knowledge". Understanding science is not just knowing facts. Learners must organize and actively build them into a conceptual framework to be useful in new settings (the definition of constructivism). But, learners must also monitor and reflect on their own learning as they learn through metacognitive learning strategies.

Metacognition should be guided to encourage students to connect new information to prior knowledge and to select thinking strategies deliberately.

Engaging students in their own learning not only encourages classroom learning, but also life long learning. Science literacy must apply throughout one's life, or else knowledge quickly becomes obsolete.

This is teaching science for science literacy. But again, I don't want to invoke the term science literacy as a label. To me it is a generalization that implies students should be able to apply scientific reasoning to personal and cultural problems they face during their lifetimes.

Let me make a few more observations before I close.

Good old fashioned Science Fairs are good PBL.

Field trips should be included in PBL, not taken as sight-seeing adventures or fun-filled breaks from instruction.

PBL should involve the collection of data and the manipulation and interpretation of that data.

Lessons should start with an experience that presents a problem and begs questions. The questions should become the centerpiece to the acquisition of content knowledge to solve the problem posed by the initial investigation.

All relevant content knowledge should be presented three times. Once during the exploration of current knowledge conducted to answer questions centered on the problem identified. Again during the discussion of solutions to that problem. And third, during the students justification of the results of their own investigations.

If students cannot place the relevant content knowledge into proper perspective relative to the problem they are solving, then they haven't learned the content correctly.

All of the links in this blog can be found at HUNSTEM's Constructivism Page.

October 31, 2006

A Gedanken Experiment for Teachers

Here's a problem for discussion, a Gedanken Experiment you might say.

There is an exercise that illustrates the potential pitfalls of lecturing and test construction, called the Monotillation of Traxoline.

See if you can pass the test that follows the scenario:

It is very important that you learn about traxoline. Traxoline is a new form of zionter. It is monotilled in Ceristanna. The Ceristannians gristerlate large amounts of fevon and then bracter it to quasel traxoline. Traxoline may well be one of our most lukised snezlaus in the future because of our zionter lescelidge.

1. What is traxoline?
2. Where is traxoline monotilled?
3. How is traxoline quaselled?
4. Why is traxoline important?

Now, this is funny, but it is made up. To provide a similar example using "real" information, I've devised the following exercise from my own specialty of paleoecology:

It is very important that you learn about arcellacean taphonomy. Arcellaceans are a major group of testaceous rhizopods. During preservation in any depositional environment, taphonomy produces different thanatocoenoses from extant biocoenoses. Thenatocoenoses are the result of differental preservation during burial, but differ between environments of deposition due to differences in original biocoenoses and soil biogeochemistry. Arcellaceans are one of our most useful paleoindicators for lacustrine environments.

1. What are arcellaceans?
2. How do thanatocoenoses form?
3. Why do thanatocoenoses differ?
4. Why are arcellaceans important?

How'd you do?

What do you really know about Arcellacean taphonomy?

Let's say you are a teacher and you have to teach this subject. You have plenty of resource materials on the subject, but no prior content knowledge. This topic is going to be on the standardized test your students will take at the end of the year. How do you teach it?

November 07, 2006

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November 14, 2006

More Monotillation of Traxoline

In a previous blog entry I asserted that instruction without concern for metacognitive construction of understanding is imperfect. You can lead a horse to water, but the learner must want to learn. This is why so many well-meaning examples of constructivism go awry. Too much focus is placed on engagement at the expense of the guided inquiry. This does not mean that the need for engagement isn't crucial, but you have to do more than just get a student's interest.

Here are some other examples of "The Monotillation of Traxoline" if not followed up by guided inquiry:

Tornado Tubes
Kitchen Chemistry
Magic Tricks
Demonstrations

My point isn't that these activities are pointless. They can be very useful, but they are not science lessons in and of themselves. They are the beginning of understanding, and only that if they are framed as an introduction to phenomena that beg explanation. Students must be guided by inquiry from the hands-on experience used to engage them into the content lesson that will fulfill their thirst for explanation.

They must still construct their own understanding, but they cannot do it on their own. Teachers need to be prepared to be flexible, and they need to be prepared to present content at the crucial time in the lesson.

All too often, hands-on activities are used at the end of a content lesson and expected to demonstrate what has been learned. This tends to make the "experiment" either superfluous or distracting depending on how well, or poorly, the content has been delivered and related to the activity.

Science starts with an observation that presents a problem in need of explanation, proceeds to collect all relevant information on the problem, and then controls experiments that test hypotheses formed to provide explanation. Constructivism poses the same guidelines for learning about science.

It's okay to say, "I don't know" to a student's question, if fact it is important to do so, so long as that response is followed by "let's find out". Science is about the finding out. The knowledge accumulated by centuries of science in practice is needed to solve new problems. No one has all of the answers, but everyone can learn to think scientifically. This includes the skills of knowledge acquisition and problem solving.

Start with a hands-on activity that presents a problem in need of explanation. Follow this with content discovery guided by inquiry, by whatever methods are appropriate. Finish by putting this information into a larger explanatory framework.

Without each of these steps, the hands-on activity is just like the monotillation of traxoline.

December 05, 2006

Kant on Constructivism

I recently attended a conference on quality math and science teaching at the Dana Center at the University of Texas in Austin. A physicist who was trying to express the philosophy of numbers used a quote by Kant that struck me as interesting.

"It is beyond a doubt that all our knowledge begins with experience."

It struck me that Kant had perhaps represented the initial formulation of constructivism as an educational philosophy. Kant's views on learning are best stated in Elements of Understanding.

Now, I know Piaget is given credit for establishing constructivism as educational pedagogy, and that constructivism as a philosophy goes back to Socrates. I'm sure that the strands of thought that separate constructivism from rationalism can be found throughout the history of thought, but I found it interesting to consider Kant's role in the relationship between philosophy of science and the pedagogy of constructivism.

Here are some other quotes from Kant:

"All our knowledge begins with the senses, proceeds then to the understanding, and ends with reason. There is nothing higher than reason."

"All thought must, directly or indirectly, by way of certain characters, relate ultimately to intuitions, and therefore, with us, to sensibility, because in no other way can an object be given to us."

"Experience without theory is blind, but theory without experience is mere intellectual play."

"Immaturity is the incapacity to use one's intelligence without the guidance of another."

"Intuition and concepts constitute... the elements of all our knowledge, so that neither concepts without an intuition in some way corresponding to them, nor intuition without concepts, can yield knowledge."

"To be is to do."

This one reminds a bit of Descartes, don't you think? Here are some quotes from Descartes:

"Except our own thoughts, there is nothing absolutely in our power."

"Each problem that I solved became a rule which served afterwards to solve other problems."

"If you would be a real seeker after truth, it is necessary that at least once in your life you doubt, as far as possible, all things."

I'm sure these simple observations on the history of the philosophy of constructivism won't help settle the debate in education over its application to methods. The underlying philosophical debate hasn't been settled after thousands of years, so why should we expect to agree on its applications to education today? I think it makes sense, but putting it into practice is not easy or automatic. Perhaps it helps to understand constructivism as a philosophy for consideration by teachers looking for the best way to teach? Perhaps this style does not work for everyone, but is the optimal approach for others? Perhaps we should allow teachers more freedom to find the style that works best for them?

Just some random thoughts. What do you think?

For more reading on the philosophy of science, check out The Philosophy Archive (http://www.philosophyarchive.com/concep.php?philosophy=science).

January 30, 2007

I Liked the Book Better

I was sitting in a meeting the other day with a bunch of engineers trying to figure out ways to improve STEM education for future workforce needs, and reflecting on my previous post concerning teacher bonuses when a thought struck me (I know that sounds painful, but it's okay, really). We need to know how well we're doing in the classroom, and we need to know how effective our teaching methods are, but using high stakes tests to tell us the answer is like condensing a novel into a movie.

Where in the world did that come from?

Well, here's my reasoning. If I'm developing a course syllabus for the first time, should I:

A) write my tests first then design the syllabus to best prepare my students for that test, or

B) prepare a syllabus covering everything I think is important and then write the test after presenting the material for the purpose of drawing the student's attention to crucial components?

There's really not a right or wrong answer. Different costs and benefits accrue from each strategy. It depends more on personality than pedagogical reasoning.

So why should we choose one strategy over the other?

It's a question of quality. Strategy A requires quality curricula which theoretically can be delivered by "practitioners". Strategy B requires quality teachers who can adjust to diverse situations and make do "on the fly".

So, we either focus on curricula or teacher quality. Trying to do both at the same time is somewhat counter-productive.

Ideally, I think we should focus on producing quality teachers who could then control their curricula. In reality this is often/usually unrealistic, so we impose strategy A even though it is difficult/impossible to accomplish for diverse settings and needs. We simply don't have enough quality teachers to accomplish strategy B.

My solution.

Stop imposing restrictions on quality teachers just because there aren't enough of them! If one teacher can take his/her students farther than the teacher in the classroom next door, let her/him! Stop dumbing down the good teachers because we have so few!

This begs a number of questions of course, but I'll leave them hanging for now. Let me know what you think, and we'll see where this goes.

February 06, 2007

A Truer Assessment of Success in Education

I'd like to follow up on my last post with another bold cliché:

Lowering the bar on education to meet uniform standards is an exercise in mediocrity.

The reality of the situation is that there are not enough quality teachers to meet uniform standards, so we dumb down the standards to achieve a standard goal. We all know this is happening even as we champion standards as a way of achieving quality.

There are two types of standards, however. Standards such as the National Science Education Standards, Project 2061, and the Texas Essential Knowledge and Skills are set as goals to strive for. Testing standards are bottom line standards which are expected to guarantee a minimum level of achievement. The problem is that whenever minimum standards are set, forces are unleashed that homogenize our expectations around these minimum levels. This means that the kids already behind get short-changed because we focus more on the test than the skills, while those students capable of going farther are held back so that we can show that every child is meeting the same standard.

We should never accept failure. We should never accept unequal treatment or unequal expectations, but if we are ever going to increase the rigor of our education system for everyone, we need to acknowledge the existing disequilibrium instead of trying to hide it under the rug. This dishonesty is only increasing under No Child Left Behind.

We must identify failing schools, not to scold them, but in order to diagnose their problems. We need to give these schools greater resources, and give teachers greater incentives to reform these schools rather than punishing them by restricting resources and structuring teacher rewards that push them away from the challenge.

Since this is Black History month, we should learn the true lessons of equality. Equality is only achieved when every child has equal access to quality. Equality is only achieved when every child has an equal expectation for future success. Equality is only achieved when every child is valued equally. Can we honestly say that the current disparity between urban and rural schools represents this equality? Can we honestly expect that the current culture of failure is the proper incentive to achieve equality?

We need to be more honest with ourselves and evaluate the success of our schools by the equality of opportunity afforded their graduates. Our meritocracy will only work to recognize equality once equal talent receives equal opportunity. This will never be achieved within the current catch-22 of standards driven by high stakes testing which produces mediocrity rather than meritocracy.

Meritocracy is a dangerous word given the institutionalized racism of tracking and school funding, but it's a necessary discussion. We want the ultimate measure of the success of our educational system to be the success of generation after generation in the workforce and the world economy. Standards are our attempt to stem the tide of losses in these areas, but when standards become engines of mediocrity than they are counter-productive.

We must replace test scores with employability, wage earning ability, equality of opportunity, and equal access to the meritocracy that ultimately measures our success.

February 20, 2007

My Favorite Problem

I always ask students in my classes to solve a thought problem to point out the need to keep a whole mind focused on learning science. Here's the problem:

Visualize three books sitting on a shelf. They are placed normally for English language books, as if on a library shelf (no tricks are intended in the positioning of the books). A magical bookworm starts on page one of the first book and chews its way to the last page of the third book. If each book has 2 inches of pages and each cover of each book is 1/6th of an inch thick, how many inches does the bookworm chew through?

This is a magical bookworm because it is a singularity. That might provide one clue to the solution to this riddle, but I must emphasize:

The trick to this puzzle is not in the math. The math is easy. The trick is in the visualization!

I give this problem at the beginning of my classes to point out how easy it is to get distracted by biases that cause us to categorize problems, thus preventing us from searching for novel solutions. New discoveries in science require us to do just this, find a new perspective on a group of observations so as to find the insight that leads to discovery.

If all we do is teach the lore of science and not the skills of problem solving, then science is dead in our culture. Certainly, our future scientists and engineers need to master more and more knowledge to approach the precipice of discovery, but how do you know to leap when you get there if you've never dared to before?

I know that my education has prepared me well, not because of the knowledge I've accumulated, but for the skills to continue acquiring knowledge both through studiousness and perspicacity. I'm much prouder of my ability to learn new things than of my acquired knowledge.

And this is what drives scientists. It's not what we know, it's what we don't know. It's what we want to learn.

Science education should instill this drive. With it, knowledge will become a tool, not an end.

So, what's the answer to the riddle? What do you think?

March 27, 2007

The right kind of question

The last comment to my post about "My Favorite Problem" was interesting to me because I feel her pain. I enjoy problems like the one in my last post the same as I enjoy doing Sudoku or Crossword puzzles, but I don't think that they are diagnostic of intelligence or academic ability. They're just fun. The same way multiple choice questions are frought with pitfalls if they are not well constructed. I don't want to measure my students distractability, I want to know what they know. I give compare and contrast and essay questions on my exams, but then I only have about 50 students a semester, so it's not too onerous.

I use the "Book Worm" problem in the introduction to my classes to introduce the need to apply whole brain thinking to science problems and to avoid getting tricked into using just one pattern of problem solving, but I also hope to dispel any ideas that there are simple answers and purely "right or wrong" answers.

I've talked about this in previous posts, such as Science Tricks and Is Black a Color. Levels of explanation are important, as are identification of assumptions and qualification of the parameters of an explanation.

If you liked the "Book Worm" problem, you'll love this one. It's taken from the problem set for "Conceptual Physical Science" by Hewitt, Suchocki and Hewitt (Addison Wesley).

A motorist wishes to travel 40 kilometers at an average speed of 40 km/hr. During the first 20 km, an average speed of 40 km/hr is maintained. During the next 10 km, however, the motorist goofs off and averages only 20 km/hr. To drive the last 10 km and average 40 km/hr, the motorist must drive:

a) 60 km/hr

b) 80 km/hr

c) 90 km/hr

d) faster than the speed of light

I use this one in my introduction too, sometimes, to show how using math as a model to solve a problem isn't always a bad thing, and shouldn't be scary. Since I'm teaching future elementary teachers, we promise not to use too much math, even though it is a physical science content course. Try teaching physics without math and you'll see just what "The Teacher with a Bad Attitude" was talking about when visualization is the only tool applied to solving non-intuitive problems. Math can be very illuminating. All tools that can be applied to solving a problem should be applied.

And this brings up another pet peeve of mine. I don't like giving students limitations on exams. Information that must be memorized is a tool for problem solving. Skills are tools for problem solving. The best "test" of a student's knowledge and skills is their application to a problem. Scientists don't limit themselves to a text book or what resources are available in their local library. We don't rely solely on Google or Yahoo or Microsoft. I tell my students that they will need to know the vocabulary they learn to understand my questions and provide quality answers, but the question will pose a problem that requires the application of knowledge and skills to answer.

It's a challenge as a teacher to get beyond the building blocks into the construction phase, but it should be our goal. If kids can be taught to solve problems then they will learn how to find the resources they need, and challenging them to solve problems can accelerate their aquisition of knowledge and skills.

April 03, 2007

Faster than the Speed of Light

That's the answer to the problem in my previous post. But is this also another way of saying "impossible"? Current science would dictate yes, but most students younger than college age would probably say no. My twelve year old would adamantly defend the reality of phenomena faster than light. He's growing up in a culture that is tacitly accepting this inevitability. It's not just the hyperbole of comic books any more. I seem to remember, from my own comic book reading days, the phrase "faster than the speed of thought" as intended to be faster than the speed of light. An appeal to metaphysical instantaneous reality outside of the constrictions of the physical world. But, alas, those pesky neurons and its all still chemistry.

Should we stamp out the idealism of youth in science class? Should we insist on dealing only with the known, and not the speculative?

One of the things our culture is currently suffering from is a lack of sufficient skepticism of pseudoscientific claims. From homeopathy to parapsychology to creationism, pseudoscience is

alive and well, and growing in our culture. This is a dangerous trend, but can we combat it by restricting science education to the realm of fact?

The lure of the future has always been a major draw to science. Science is about the future, and the correlation between fantasy and science fiction interest and interest in becoming a scientist is important. We want kids to learn to explore, not just recite facts. We want kids to yearn for discovery, not just become proficient with modern technology.

Is our crisis in creativity greater than our susceptibility to pseudoscience? Are we on the horns of a dilemma?

No.

The solution to both crises is better science education, and better science education should look to the future, speculate, and even dream. Scientific theory is designed to make predictions about the future.

What's gone wrong is a poor understanding of scientific theory.

Without an understanding of theory people are gullible to claims that "the future is here now". A truer understanding of science will allow people to distinguish between hopeful claims and out-right fraud. It will allow people to participate in their futures. And it will allow people to dream without being gullible.

We should teach science towards an understanding of theory. We should make it clear that all of the lore that has accumulated and is taught in "science class" is only a tool for functioning theory. We should make students understand that the whole "point" of studying science is to look to the future.

April 24, 2007

HUNBoxes

We have developed a series of hands-on science lessons called HUNBoxes. I send my pre-service teachers into extended day programs in Fort Bend ISD to do a HUNBox as an assignment in my Physical and Earth Science content course. The student must design the lesson for the HUNBox and deliver the lesson to three age groups: early childhood, early elementary, and later elementary. Each lesson takes about 30 minutes and must be hands-on. We provide the materials and supervision.

Nothing really new about this so far, museums typically have similar boxed lessons available to schools. Not all of them come with a docen, however.

The difference with HUNBoxes, however, is three-fold:

1. My students must design their boxes to be flexible across age groups. They must think about levels of explanation and how to deliver content progressively. This is important for pre-service teachers to experience because it makes them focus on content strands (TEKS strands, as the case is here) which develop a concept across grade levels.

2. I instruct my students to start with an interactive experience for the children, use inquiry during the hands-on activity, then follow up with content. This is a struggle for most of them since they are more comfortable lecturing first then proceeding to the activity. The benefits of allowing the children to do an experiment before being "lectured" is that they develop interest and the cognitive "hooks" for understanding that allow them gain metacognitive control of the information that follows. And before I get too many people yammering about how inaffective this is, keep in mind that these are short introductory lessons provided as supplementary to classroom experiences. They could be used to intruduce a concept in the classroom, but they are more valuable as "extra" work that may spur kid's interest in the classroom the next time they hear the "key words" presented during these experiences. This is free-choice learning, and kids I've observed usually take the lessons and run with them, but it's not just fun. The teachers must design inquiry into the lesson and cover real conten goals.

3. My teachers are learning as much as the students they are working with. Many of them have commented about how they would never have thought to present a lesson this way, but having done so they recognize just how much better the students learning the material. They are amazed at how involved the kids get in their activities and at how eager they are to resond to questions when they have a chance to put the answers into action.

We're looking to expand this program in the Houston ISD for their alternative and charter schools program. Let me know what you think we can do to make this program even better.

August 25, 2008

A New Paradigm for Public Education

A while back I wrote a blog about a new paradigm for public education (Devil's Advocate). I also mentioned the need for a new paradigm for public education in this entry: Why We Can't Blame Teachers.

I'd like to spend much of this year expanding on this paradigm.

I haven't been blogging for awhile, though my students have been contributing to HUNBlog. I will try to write my own entries throughout this semester, primarily on my thoughts about this new paradigm, but on other things too.

Anyway, here goes:

Let's start from scratch. Let's assume that there has never been public education but we now realize the need for it. In today's milieu, what do we need to do to insure the best education for every student?

Here are a few ideas I want to develop. I'll be brief and general at this point. Let me know what you think and we'll see where this goes:

School is not a centralized location. Students should meet with their teachers in a variety of locations, such as informal science centers, museums, public libraries, parks, plants, factories, office buildings, government buildings, etc. Accomodations and transportation can be arranged, and integrated curricula can be developed. A centralized school can be used for some lessons, test taking, assemblies, etc.

Curricula should be integrated across all disciplines.

Technology should be used to provide resources to students at all age levels. I'm not talking a lap top for every student, that's already obsolete. I'm talking about something along the lines of a pda/phone. Textbooks, internet access, podcasts, bulleting boards, etc. should be utilized to communicate to students and collect assignments (electronically). Come on, seriously, if we're starting from scratch, isn't this a no-brainer?

Content standards can be assessed through standardized tests, but this should only be half of the students final grades. The other half should be performance based. Students should have to show that they can apply what they've learned to actual tasks.

Funds for public education should come from the industry and businesses that benefit from a well educated population. Businesses and industry should be taxed according to the number of employees, and funds should be distributed to schools/school districts according to the number of students they educate (with some adjustments for cost of living differences, perhaps).

Funding should be coordinated at the federal level. National standards should be developed for the integrated curriculum, with content strands and expected outcomes for skills, but there should be plenty of room for teachers to adapt the guidelines to their student's specific needs. Teachers should be paid well, and they should be trusted to develop appropriate curricula and assessment for their students.

Okay, have at it!

September 03, 2008

In Memory of Cherri Brinley

A dear friend of mine passed away over the weekend. She was a middle school science teacher, and she was the best I've ever known. She was the best because she enjoyed teaching and

because she truly cared about her students. I know that may sound trite, but there is no better way to convey the truth of her professionalism as a teacher.

She also taught science the way it should be taught. She serves as a perfect example of how inquiry and PBL can be done effectively. I know that inquiry and PBL are difficult, but Cherri was able to do it. She was able to do it because it was fun for her. She constantly learned new things and sought out new projects. And she did the projects alongside her students. Cherri's students even trained other teachers on her lessons in rocketry for NASA.

When I first met Cherri she was undergoing chemotherapy. She was also struggling, I think, with her self-confidence as a teacher, but I could see then that she was special. She asked me if I thought she should apply to a program at NASA and if I thought she was qualified. I told her she was exactly the type of teacher they needed. She applied and was accepted, and she proceeded to take that opportunity and turn it into an amazing run for herself and her students. I watched her confidence and her hair grow back over the next few years, and I was constantly amazed at her resilience and dedication.

Cherri was dedicated to doing things right even when it wasn't easy. Like any science teacher who uses inquiry in their classrooms, she had parents and administrators who didn't always understand the value of what she was doing. I know that it hurt her when she was rebuked for "not using the text book" or "taking too many field trips" but she knew she was doing things right and she perservered.

Her students certainly know she did it right. The number of former and current students attending her funeral service was testament to that. The number of students signing her guestbook, and the experiences they shared are a testament as well. But the greatest testament to her success is the number of students from her classes succeeding in high school and college. I know a lot of teachers through HUNSTEM, and I know her students are well thought of. This is the truest assessment of teaching. Her students are not only successful in their studies after her teaching, but they remain interested in science whether they plan to pursue it as a career or not.

Cherri couldn't beat cancer the second time, but she has forevor won the minds of her students and the hearts of all who knew her.

I'm writing this tribute to Cherri in HUNBlog to show that science can be taught through the principles of constructivism. It isn't easy, but when done right, it's the best way to teach science. For any teachers who are using inquiry and PBL, keep at it. Keep learning and keep searching for new experiences for yourselves and your students. Stay strong in your knowledge that you are doing it right.

Look to Cherri Brinley for inspiration. I know I do.

November 05, 2008

Welcome to the Meritocracy

Last night's election was historic on many levels. One of the most interesting things said about it was that "the election has changed the gray matter of the country". Washington Post columnist Eugene Robinson made this comment on MSNBC last night in trying to describe the impact the election has had on him, and will have on all of us in both profound and subtle ways. Many commentators have talked about how this election will change the psyche of America and the world.

I've been trying to think about this phenomenon in terms of what it means for education. I believe it could have subtle and profound impacts here as well. In the most profound way, I believe that Barack Obama's success resonates as a blueprint for the American Dream, and that it is now finally and truly available to everyone in this country. How many times did we hear last night from teary-eyed civil rights leaders, "now we can tell our children that they can be anything they want to be, and now we will be telling the truth".

While this shift in ideology is profound in itself, what is even more profound for education is in the analysis of the blueprint. Barack Obama is where he is today because of education. Anyone looking at his story can now see clearly that the pathway to the American dream is through education. What is soaking into the gray matter of this country right now is that the hope of our future is through the education of everyone in our society.

Barack Obama talks about how his mother would wake him up early to study. This resonates with educators on at least two levels. One, his family valued his education, and was integrally involved in his disciplined journey through the education system. Barack Obama rose from a modest background into the intellectual elite in this country through education because it was expected of him, and because he had the support of his family . And two, education is hard work. Here is a man who I've already described as intellectually elite. A man who attended Harvard Law School and edited their Law Review. A man who eloquently addresses and analyzes complex issues. And, he worked hard in school.

We have much work to do to make the dream of equal education for everyone a true reality. There are still too many inequalities in the state of facilities, the allocation of resources, and the veracity of our commitment to the schools in our under-served communities. These inequalities will not be overcome easily or quickly, but now there is a new mind-set for the students, teachers and parents at these schools. For the first time in many of these communities, it is conceivable that hard work can lift a child from the conditions of their surroundings to the heights of their imaginations. It is now conceivable that any child who works hard can compete in America's meritocracy and be rewarded. For the first time, it is conceivable that though barriers will still exist, there is a pathway through them that leads to success.

If this indomitable spirit oozes into the gray matter of all of our children, all of our families, all of society, then our educational system can finally become the meritocracy it has promised to be.