The Fulcrum Flash

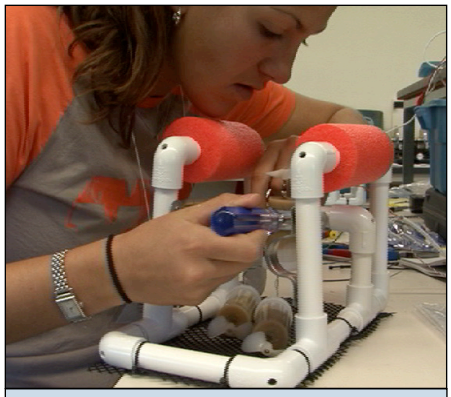
Thirteen Sturdy ROVs Set Sail

Fulcrum teacher Jason Young puts finishing touches on his SeaPerch.

The Office of Naval Research and the Society of Naval Architects and Marine Engineers partnered with Fulcrum Institute to offer a workshop on building ROVs.

A group of 15 educators met the challenge of making **R**emotely **O**perated underwater **V**ehicles on Friday, October 23 and Saturday, October 24 at Tufts. They participated in a hands-on workshop which dared them to leave comfort zones and pick up soldering irons and heavy-duty drills.

The educators came from a variety of sites; including a few home schoolers, some local high school teachers, and an eager team of fourth grade teachers from Dr. Elmer S. Bagnall School, site of Fulcrum Fellows Nancy Wile and Pat Adams. Bagnall teacher Tracey Connors shared, "*I am still in disbelief that I actually made the SeaPerch. The experience took me outside of my comfort zone, as I am sure many students feel at times. Nice to share those shoes to see how they feel."* Tracey's colleagues at Bagnall, Hillary Seager and Barbara Duda, worked together; *"We found the activity challenging since it was our first time wiring a remote control box and making propeller driven engines. It gave us valuable insight into how the kids feel when we ask them to do a project. Once comfortable with the tools, we were able to move at our own pace."*



Malden High Teacher Shauna Campbell puts the finishing touches on her SeaPerch.

"By the end of the workshop, we were impressed with all we had learned and were comfortable enough with the tools to see how our work could be translated into a fourth grade project. We promptly went out and purchased our own soldering guns to use at school. Since we teach electricity and motion and design, we were thinking the students could make their own remote control electric cars."

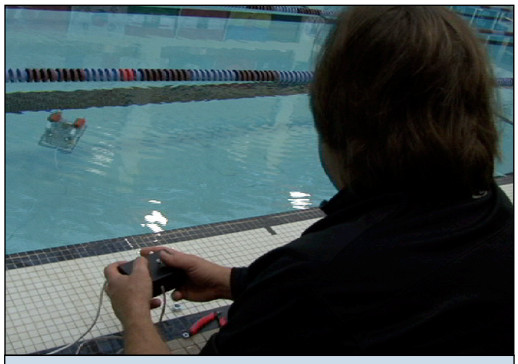
Groveland Teachers Tracey Connors, Hillary Seager, and Barbara Duda, working as a team.

Diana Cost of Weymouth High School has an interesting plan for her school's science and engineering club. Diana's intent is, *"... to ask students to redesign the SeaPerch to improve its use. Students will also research the engineering principles that are used in marine technology."*

Two Fulcrum Participants, Jason Young and David Grondine, also attended the workshop. Jason compared his experiences to his teaching; "*I regularly encourage my students to use their creativity in science, and this experience allowed for just that. It has also given me another example of how in science it is okay to experiment and get something 'wrong', as long as you are learning throughout the process."*

David also had a good workshop; "*By the end of the second session, I felt like I was a little kid again playing around with a real, working, remote controlled submersible."*

David obtained 12 SeaPerch kits and plans to set up an after-school club to build SeaPerches with a group of middle school students. Now all he needs is a pool...



David Grondine feeling like a kid with his ROV.

***Look for a video of the workshop on the Fulcrum website.**

News From the Classrooms

The Fulcrum Participants are making great strides at their schools, and I had the opportunity to see some of the students in action. Fulcrum participant Ashley Marshall is the Science Specialist at the Samuel Adams School in East Boston. Ashley has started an Ecology Club at her school, and when I went for a visit last month there was a guest speaker from the New England Wildlife Center. He was sharing objects from nature and providing her 'city kids' with a passion for the natural world.

After leaving East Boston, I spent some time in Luis Arroyo's classroom at the Charles Taylor School in Mattapan. Luis is also a science specialist at his school. His fifth grade students were comparing the physics of how weight affects velocity using cars that they had made the week before. Luis told me that he has been able to bring a bit of grant money into his district and is willing to assist any colleagues that would like help in grant-writing.

Later that day I visited the classroom of Jan Preheim at Lincoln Elementary School in Brookline, where her fifth graders were noticing the intricacies of a butterfly's wing. Jan had set up a number of learning stations, and the students really enjoyed creating diagrams and reports on a variety of butterfly species.

Judy Gibson and her students were rocking and rolling on the morning of my visit to the Franics W. Parker Charter School in Deven. One student had brought in a device in which they had placed rocks- one for each student. The students were trying to identify their individual rocks which had been tumbling around for a week. They used drawings and notes taken from their science journals to help solve the mystery. I then crossed the hall to Nancy Griffin's classroom where the students were also studying geology and were starting to create geological timelines. Nancy and Judy collaboratively create their lessons.

Excellent Resources to Consider

thephysicsfront.org: *Resource materials from the American Association of Physics Teachers*

phet.colorado.edu/index.php: *Fun, interactive, research-based simulations of physical phenomena from PhET project.*

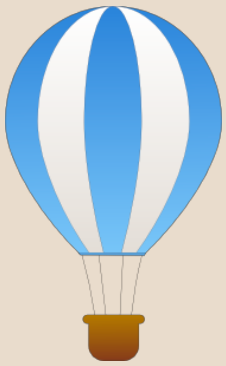
teachnet.ie/mamond/2006: *Quizzes, online activities, and assessments: astronomy, biology, botany, chemistry, and physics.*

Tufts: *Leaders for Change to offer Grant Writing workshop to Tufts students on February 11, 2010. Information: ocl@tufts.edu*

UMass Amherst Saturday Seminars for Science Teachers
Information: mort@umassk12.net,

Something to Think About

Everyone knows that hot air rises- that is how hot air balloons work. Suppose you had a very light, but rigid sealed container filled with air at room temperature. If you heated it, could it float? Is this situation different in any important way from a real hot air balloon?



Michele Kitanov teaches sixth grade at the Pine Grove School in Rowley. On the day that I visited, Michele's students were exploring mass and weight with beam balances, getting ready for an upcoming inquiry-based investigation. It is important to practice using the tools, and her students were gaining confidence as they determined the objects' characteristics.

Upon arriving at Betty Ann Vitale's classroom at Conant Elementary School in Acton, I was presented with a first grade burst of enthusiasm for learning. The class was exploring various hands-on activities, and were delighted to share their knowledge. Betty Ann told me that she was glad to connect her two worlds, Fulcrum and the classroom.

Erin Suffoletto who teaches at the Doherty Middle School in Andover, was working with her eighth grade students as they completed an investigation of Heat Transfer, something very familiar to our Fulcrum participants this semester! Erin's students created mini flip charts with information on Radiation, Conduction and Convection. There was evidence of learning because they were able to share everyday examples from their own lives.

At the Timony Grammar School in Methuen, Cindy Nugent has been demonstrating model lessons for her colleagues. On the day that I visited, Cindy was challenging a fourth grade class to solve the prompt 'What is an ecosystem and does matter and energy affect it?' The students had visited a nearby pool the previous week and were finalizing sketches and notes in their science journals. The classroom teacher told me that she is very appreciative of Cindy's mentorship and plans to continue following the structure that Cindy had been modeling.

It is a treat for me to spend time with our Fulcrum teachers as they share their passion for science with their students and colleagues. I look forward to visiting another handful of Fulcrum teachers in the upcoming months.

Carole Bersani

Formative Assessment and Probing Children's Thinking

The Fulcrum Institute focuses not only on science content, but also on pedagogy. Tufts associate research professor Linda Jarvin, joined Fulcrum as a guest commentator in October to share her knowledge of Formative Assessment. Below, she explains the need for clear learning objectives.

> *Formative assessment cannot be done without having clear learning objectives. Learning objectives are not teaching objectives. In other words, learning objectives specify what the students should be able to do as an outcome of the lesson or unit (e.g. 'by the end of this lesson students will be able to compare and contrast two forms of government'), whereas teaching objectives focus on what the teacher should cover (e.g., "in this lesson the class will review two forms of government").*

The following is a discussion between two Fulcrum participants as they consider how to create strategies for formatively assessing students in a whole class setting,

> *In their science journals after each investigation they write a quick reflection. Sometimes it will be a 'What do you think- question' that I write on the board, and other times it will be a quick reflection on what they learned, what they are surprised about, or what they still wonder about.*
>
> *The reflective pieces are so telling as to what a student understands and where their thinking is breaking down. Also, it's telling in terms of as a whole, if the majority of the class is getting it. That really helps to shape future lessons.*

Our Fulcrum teachers benefit greatly from the input of colleagues because their discussions are candid and grounded in the varied experiences they have had as teachers and learners.

> *To take a constructivist view of knowledge and reasoning is to believe that children construct new understandings and abilities from the understandings and abilities they already have. It means seeing children's minds as fertile and generative, rich with raw material from which to construct. If we want children to make progress in science, we should study their reasoning for that productive raw material.*
>
> *David Hammer*

After studying formative assessment, the Fulcrum teachers looked at research in children's thinking about heat and temperature. The specific assignment was to analyze an interview with a child, and then conduct their own heat transfer interviews with one of their students.

The guest commentator for this on-line session was Kristen Wendel, a Tufts PhD candidate. She shared her insights and experiences with the teachers.

> *I often use one-on-one interviews as a technique to probe children's thinking about science. I like to think of science interviews as 'conversations about phenomena', and I have come to see these conversations as an extremely valuable tool for designing science instruction.*
>
> *The explicit goal of this Fulcrum session was to understand how to collect and interpret evidence of children's thinking. You also considered what to do next with that evidence. I'd like to consider three purposes for having "conversations about phenomena":*
>
> *(1) to uncover children's ideas about phenomena,*
>
> *(2) to uncover their approaches to generating ideas about phenomena, and*
>
> *(3) to help them – and their classmates – clarify and advance those ideas and approaches.*

One teacher had shared with her colleagues frustration with the fact that most of her students were not able to apply previous learning to a new situation, and in response a colleague offered some advice,

> *I think sometimes kids get caught up in words, but if you model for them how you would apply your previous learning or experiences to the new situation, that might trigger some connections.*

This evidently inspired self-reflection within the first teacher because she then replied;

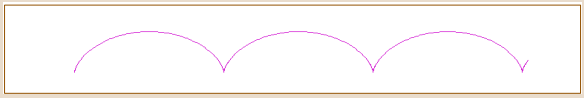
> *I need to do this more often, just thinking out loud may help. Also, I think I may copy student journal entries to show examples of students doing this.*

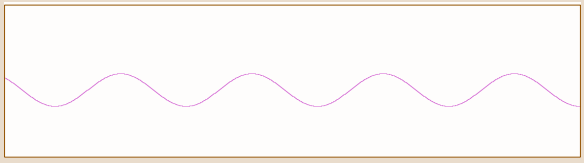
The wealth of knowledge and information shared among the Fulcrum participants and their guest commentators continues to strengthen their understanding of how to choose the most effective methods of teaching.

Fulcrum thanks our guest commentators for their relevant and useful contributions to the discussions on formative assessment and probing students' thinking.

In the last issue we gave you something to think about...

A pebble is stuck in the tread of a tire on a car traveling in a straight line at a steady speed.





One image shows how the height of the pebble above the ground varies in time. The other image shows how the height of the pebble above the ground varies in distance.

Which is which, and why do you think so?

Here's the resolution, and a little more to think about...

Plot the height of the "pebble" at different ***times*** by measuring the distance from the bottom of a clock to the tip of the minute hand.

Measure on the hour, 5 minutes after the hour, 10 minutes after the hour, etc. Make a graph with the distance above the bottom of the clock on the *vertical axis* and time on the *horizontal axis*. [The clock does not have to be running in order to do this.] Doing this will produce one of the images.

You can make the other image in the following way: Make a straight line on a long piece of paper. Using the same clock, mark a point on its circumference. Lay the clock down on the paper with the bottom touching the long line you have drawn. Make a mark on the paper next to the point on the circumference that you marked. Now roll the clock along the long line and once again place a mark on the paper next to the marked point on the clock's circumference. Keep doing this. You will generate the other of the images which shows how the height of the "pebble" varies with ***distance***.

National Science Foundation
WHERE DISCOVERIES BEGIN

Tufts UNIVERSITY
School of Arts and Sciences

Fulcrum Institute
leveraging leadership in science education
Paige Hall, Medford, MA 02155