# The Fulcrum Flash

## The Search is on for the First Fulcrum Fellows

The word is out! Fulcrum Institute has been granted supplemental funding to establish a fellowship program for elementary and middle school science teachers. This will make it possible for 4-6 Fulcrum teachers, in high-need school districts, to become Master Teachers in Science Education. This will allow them to exercise the leadership skills, which they developed during their experience within the Fulcrum Institute. The focus will be on mentoring teacher colleagues in science content and pedagogy.

It is not always easy for the Fulcrum teachers to incorporate the valuable experiences gained during the Fulcrum Institute. With this supplemental funding, experienced Fulcrum teachers will be able to work with their teacher colleagues to maximum effect.

Fulcrum staff are excited about this program and look forward to enabling a group of fellows to carry out Fulcrum's important goal of producing leaders in the classroom, school and profession.

## Fulcrum Principals Aim High!

Our Fulcrum Principals play an important role throughout the Institute. We rely on them to support their teachers on a variety of levels. We have decided to spotlight Principal Melissa Matarazzo of the Higgins School in Peabody, where Fred Bruno teaches sixth grade Life Science. As a Fulcrum student, Fred finds the on-line session topics refreshing, and enjoys sharing his experiences with his colleagues.

Principal Matarazzo illustrates how Fulcrum has positively impacted her school, "Our teachers in Fulcrum...discover, engage, and experiment in just the way that we'd like students to be able to do in class." The teachers strive to create "real" science opportunities for their students, and "Since they meet with grade level teams of science teachers once a week, there is a ready outlet for sharing great ideas and new strategies."

Matarazzo has a vision of where the school is headed in the area of science education, "We are aiming for more opportunities for science to be connected with actual student experiences. We are working to integrate a seismograph, a community garden, and robotics into the regular practice of learning science at our school." In eighth grade, she worked collaboratively to design a colony on Mars and has fond memories of how inspired she felt by the discoveries made and problems solved. This "real" science made a strong impression.

She is ready to support her teachers and understands the significance of her role as a Fulcrum Principal, "Ensuring that teachers feel comfortable and confident to embark on a journey of discovery with students is a challenge. I'd like to be better at encouraging them to dive in and see how it goes!"

### Something to Think About

One measure of obesity is what is called the body-mass index. It is calculated by dividing your weight (in kilograms) by your height (in meters) x your height (in meters). [A good range of values of body-mass index to aim for is between 18.5 and 25.]

Why do you imagine that the public health people have invented a measure like body-mass index rather than use density as a measure of obesity?

## What Has the Current Cohort of Fulcrum Teachers Been up to?

Our current cohort of Fulcrum Teachers has successfully passed the halfway mark of their online course. They have been hard at work, thinking about their own science *learning* and their actual science *teaching*. They are discovering what "inquiry" looks like in practice, as they solidify a set of facilitation and planning strategies to support students' science learning.

The intellectual work is evident in their responses to the prompt, "As you reflect this week, see if you can pinpoint ways your ideas about inquiry are changing, becoming more or less clear."

- I feel that my understanding of the inquiry model is more complete. I see my role as that of a guide, leading the students through the process, and the students guiding their own learning and taking ownership of it.
- Inquiry learning integrates numerous process skills at once, but it would be beneficial to teach some of these process skills in isolation (e.g. predicting, using models) to make sure that students have a clear idea of expectations.
- Kids often look to the teacher for approval of ideas. Carefully crafting questions helps kids realize that they can arrive at their own understanding. It's easier to "tell" the kids what they need to know and move on, but real learning comes from letting them struggle a bit.
- I'm attuned to the idea that the inquiry loop is the key to science. I need to make sure students predict, cycle through the inquiry loop, reflect, and are able to loop back if needed.
- While I am experienced in differentiating instruction in math and literacy, I do not know enough "science" or enough about "how children actually learn science" in order to vary my teaching to meet the needs of all learners.
- Instead of grading the labs with a rubric, I pose questions to the kids to get them thinking about things in different ways. I'm not always sure that I'm asking the right questions, but it does encourage the kids to try something new.
- I wouldn't necessarily say that my thinking has changed around my approach to teaching science; it's just that I have a clearer vision as to HOW to do it. I feel more comfortable with science in my classroom and with allowing students time to explore. I feel I have direction; a better idea of where I'm headed and why.
- Many students feel that when the lab is over, the thinking is done. I am trying to transform that mindset into one that realizes that the thinking or analysis is an ongoing event.
- I see the inquiry model as an exploration of several ideas about one topic. The inquiry model seems to be flexible and really is easily tailored to the learning needs in front of you. I say this because students will be asking questions that will drive the direction of an investigation once they know how to ask questions.
- I have become more enthused with each investigation we have done about the science inquiry learning strategy.

*A young scientist in Kathy Eliss' class at the Donaghue School in Penucket examines the movement of color.*

## What Are Some of Their Ideas for Future Lessons?

One of the benefits of being a Fulcrum participant is the teachers have an opportunity to discuss their thoughts about teaching with their teacher colleagues. The participants are sharing their ideas about planning a project.

- I decided to make the big project "Design your own experiment." I've scaffolded where necessary, but otherwise let students take their ideas wherever they lead. I have required only that they ask themselves questions, control their experiments and collect solid data. Oh, also something about not blowing up the school.

- I would like to do something with density. Have students discover the meaning of density, determine that it does not change with amount, and finally determine how it can be used to identify a substance.

- I think that I will try to focus on soils and erosion. Maybe exploring how different soil composition affects erosion, or how soils are formed. This would be a good link between our Earth and Life Science concepts.

- I think I may investigate landforms: evidence of changes in the surface of the Earth, factors that might cause changes, soil components.

- My first idea is about evaporation based on surface area. While I like this idea, it seems like a very simple experiment. I don't know how good it would be for the inquiry model. It is basically 3 containers are filled with the same amount of water, and you see which one evaporates the quickest. My second idea is about air pressure, always staying the same or if it changes, does temperature affect it?

National Science Foundation
WHERE DISCOVERIES BEGIN

*Students in Kelly Paquin's class at the Glenwood School in Wachusett discover how darkness affects their pupils.*

## Radio Series on Women in Science Wins Award

A series of programs about the changing role of girls and women in science and engineering, funded by the National Science Foundation, won recognition as winner of two 2009 Gracie Awards. These awards are made by non-profit organization American Women in Radio and TV.

Produced by WAMC Public Radio in Albany, New York, "The Sounds of Progress: The Changing Role of Girls and Women in Science and Engineering" is a two-part project. Part I is a series of eight stories that examine groundbreaking research and the implementation of research-based practices throughout the U.S. designed to increase the role of young girls and women in science, technology, engineering and mathematics (STEM). Part II offers 26 two-minute radio modules about fascinating women throughout history who were pioneers in STEM fields as well as stories researched and recorded by middle school girls about their favorite women in STEM.

For more information, please visit the site www.womeninscience.org.

## Women in Science Conference

Mette Schwartz, Fulcrum Graduate and Middle School Science Curriculum Coordinator in the Shrewsbury Public Schools, played a pivotal role planning and implementing a recent Conference at Worcester Polytechnic Institute (WPI).

The Central Massachusetts STEM (Science Technology Engineering and Math) Network, WPI, Quinsigamond Community College, and the Shrewsbury and Westborough Public Schools, sponsored a forum for middle school girls interested in science and engineering. State Representative Karyn Polito, Shrewsbury and Westborough teachers and administrators, along with college faculty and outreach staff, planned the event which took place on the WPI campus on Saturday, April 4, 2009. The conference featured women engineers and scientists working in industry, public service, and higher education. Speakers presented informal seminars, providing the girls a close-up view of what it is like to be a professional woman working in a STEM field.

The Massachusetts STEM initiative is working with stakeholders in education, research, and industry, to increase student interest in careers in STEM fields. The Initiative is committed to increasing the number of qualified teachers in STEM fields and providing them resources and training so that students of all ages levels benefit.

Because women are choosing STEM careers at lower rates than men, it is important to reach out to young women *before* they turn off to science and math. Middle school students have very little sense of what careers in STEM fields are like. The Conference forged personal connections, thus providing role models for the students.

One of the state's STEM Initiative goals, to "dramatically increase student interest in STEM," was evident by the enthusiasm and energy felt by all that participated at the Conference.

*This young scientist in Corinne Balyk's class at the Glenwood School in Wachusett, discovers how shape affects movement.*

## What About the Men in Science?

Three Tufts Fletcher School students, Michael Mintz, Kunal Gupta, and Matthew Hnatio, came up with a design for paint that can peel from surfaces. Their plan for Peelable Paint recently took top honors in one of two competitions run by the Entrepreneurial Leadership program. The three students won a $50,000 grant from the School of Engineering's Gordon Institute.

Peelable Paint, and its companion Peelable Primer both "look and act like regular paint except that they can be peeled off of a wall by hand in one giant sheet."

*Chris Wright, doctoral student*

Chris Wright is a doctoral student at the Tufts University Center for Engineering Education and Outreach.

Wright works on the Transforming Elementary Science through LEGO™ Engineering research study, investigating a design-based approach to primary science instruction. A main goal of his work is to determine how curriculum based on LEGO™ engineering-design challenges affect science learning in third and fourth grade classrooms. Four new science curriculum modules based on LEGO™ engineering challenges have been developed, and the group is studying the enactment of these modules by collaborating teachers in local urban schools.

## Online Moderating Guidelines

*George Collison*

I was delighted to be invited by Fulcrum to serve as one of the facilitators for the current group of teacher participants. At the opening Launch back in January, I met Tufts physics professors (now with different names because my instructors had retired), and it felt like coming home.

The Institute's online discussions are blooming! As a facilitator, I use moderation skills learned at the Concord Consortium, Facilitating Online Learning (Atwood 2001).

One objective of Fulcrum's on-line course is to assist the teacher participants as they develop science leadership skills. Each teacher is asked to serve as a discussion group leader at least once during the course. The presence of moderator support allows the participants to focus on the basics of moderation, which are not unlike techniques used in face-to-face discussions.

Three guidelines that have been shared are:

- A moderator mirrors ideas to concentrate attention on important issues. Holding up short individual responses is a good strategy. People often see their own thoughts in others' words.
- A moderator can offer an opinion, but only in a foggy, inconclusive, even confused way. I call this the "Colombo" voice (old detective show - I'm dating myself). The planned imprecision invites others to jump in, comment, and clarify.
- Honor each contribution, and then invite more clarification if a problem or an idea warrants further discussion. Be clear and succinct.

Our thinking space and time are limited. It is important not to over-moderate. One, or at best two, short posts on separate issues is best. It is recommended that only one per post is used.

Two styles that should be avoided, *The Question Mill* and *The Good Student*.

> *The Question Mill:* Online courses can be very intense intellectually, and often more mind occupying than "sit and listen" courses. Too many questions overwhelm.
>
> *The Good Student:* Teachers understand the mechanics of being a "good student". They identify main ideas, comment outline etc. well. A moderator must leave all sorts of open space for others to comment; their ideas must fill the pages. Vague and craftily ambiguous is good; encourage dialog that will tidy up any loose ends.

A good moderator is clear, concise, vague, ambiguous, honoring of contributions, directive, and non-directive; s/he is all of the above, but foremost, the moderator is brief.

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

Is a cell phone heavier when it is ringing? Is it lighter? Does the ringing make any difference in the scale reading? Why do you think so?

## Here is an explanation, and a little more to think about...

When a cell phone rings some physical part of it moves back and forth, making the sound that we hear. The cell phone might (depending on orientation) impart vibratory motion to the scale. This could mean that the scale reading might "wiggle" up and back around some average value.

This is a case of an issue to consider about all measuring instruments- they do not respond instantaneously. For example, if you measure your temperature with an oral thermometer it takes a few minutes with a mercury thermometer or 30 seconds or so with an electronic thermometer, before you can get a stable reading. Step on a bathroom scale and you have to wait for the dial to rotate, slow down and stop before you can read your weight. This property is called response time. For the scale reading to wiggle in the case of our ringing cell phone the response time of the scale would have to be much smaller than the time it takes the ringer in the phone to make an oscillation. How fast is the ringer going back and forth?

If the ringer on the phone were a pure middle C tone (as on a piano) it would be going back and forth 220 times a second! Do you think the scale could respond to the push of the cell phone in 1/440 of a second? A ringer ringing at two octaves below middle C would be going back and forth 55 times a second. Do you think the scale could respond to the push of the cell phone in 1/110 of a second?

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Fulcrum Institute leveraging leadership in science education