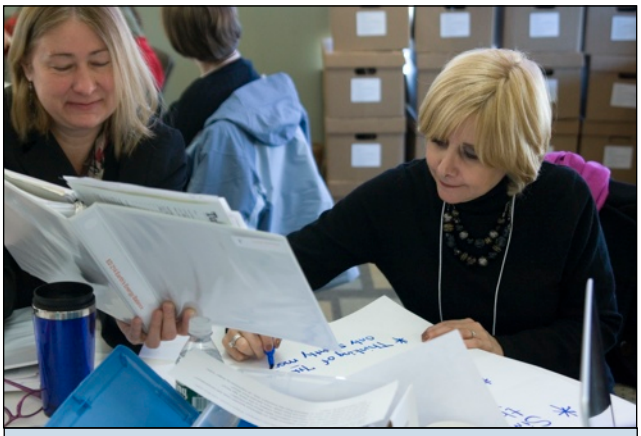
The Fulcrum Flash

Cohort 3 Launches its Final Course

On Saturday, January 23, 2010, the Cohort 3 teachers gathered together to enter into *Earth's Energy Balance,* the third and final course of their Fulcrum journey. In addition to the participants and the Fulcrum Team, there were some special guests that were able to participate as well. Lynne Pepall, Dean of Arts and Sciences, started the day by commending the participants on their involvement and dedication as graduate level students. Martha Heller Winokur, Senior Project Manager of Tufts Center for Applied Child Development and Education Development Center, and Mary Anton-Oldenburg, Principal of the Bowman Elementary School in Lexington, shared a conversation about leadership in the context of teacher study groups and professional learning communities, respectively. Fulcrum Fellows Cindy Nugent, Joel Blackmer, Pat Adams and Nancy Wile also spoke about their hurdles and successes from the first half of the school year. All six of the panel members were helpful as they provided specific insights based on their own individual experiences. Tufts Alum Bill Koster spent the morning with the teachers, fueling his interest in science education.

It was a very successful and energetic day, and the teachers went home eager to try out their new light probes and spectroscopes...

Tufts MAT student Jerib Carson joins Fulcrum participants Bryan Sheckells and Chris Stark as they discuss student interviews.



Fulcrum teachers from Medford, Donna Laskey and Loreen Romano compare results of student interviews at the Launch.

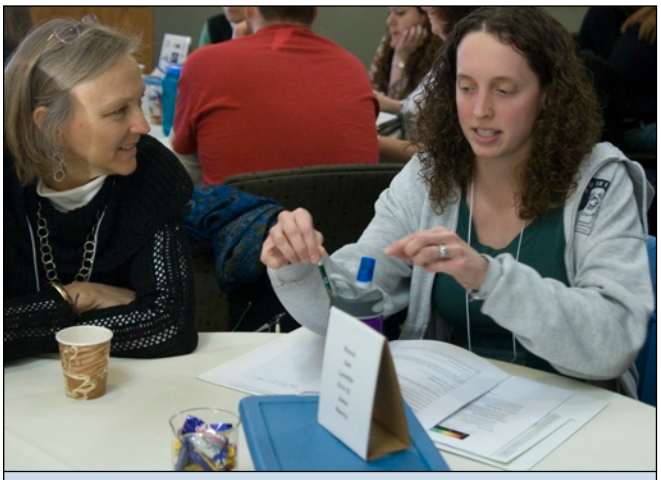
NSF Hosts Math and Science Partnerships in Washington, DC

The day after the exciting and exhausting Launch, a team of Fulcrum folks (Linda, Carole, and Nancy) headed to DC to share experiences and ideas with representatives of other MSP programs. Every year the NSF hosts a conference for all programs. Its focus is to promote teachers' professional development in math and science through partnerships between school districts, colleges and universities, and non-profits.

Among the projects, Fulcrum stood out. Math projects are much more common than science; Fulcrum focuses on science – Physics! We work with K-8 teachers; far more projects focus on high school teachers. Few programs ask as much of their participants as we do; our teachers meet and exceed our high expectations. Also notable is the effect that Fulcrum has on the participating professors, as shared by one of the key players, Roger Tobin.

"I'm sure I've learned at least as much from Fulcrum as the teachers. The intense discussions with the other scientists, educators and course developers have forced me to rethink some of the big physics ideas, understand the challenges they present to learners with limited science and math backgrounds, and wrestle with how to convey them in a way that is intellectually honest, accessible and engaging. I now think about and teach physics differently than I did before."

Roger Tobin, Professor and Chair,
Tufts Physics & Astronomy Department



Fulcrum Fellow Nancy Wile and Fulcrum participant Erin Goulding share ideas and observations at the Course 3 Launch.

Fulcrum Fellows in 2010-2011

Last year, the Fulcrum Institute carefully selected a small group of outstanding teachers to participate as Fulcrum Fellows for the 2009-2010 academic year. The Fellows were chosen based on their clear plans and the promise of solid support from their administrators. This support has been critical to the Fellows' success as they mentor teacher colleagues in professional growth and development.

We will begin accepting applications for the 2010-2011 academic year. Interested teachers are invited to apply in teams of 3-5 colleagues. This is a change from the first cohort of Fellows who applied as individuals. Based on the success of the first cohort of Fellows, and thanks to increased funding from the Noyce Foundation, we are able to accept a greater number of Fellows for a second cohort.

Applicants must be teaching in high need school districts and have at least one team member who has completed the Fulcrum Institute. *Visit Fulcrum's web site for details.*

Summer Energy Workshop

The Fulcrum Institute is pleased to announce a brand new workshop to be held this summer in collaboration with the Massachusetts Association of Science Teachers (MAST) and the New England Section of the American Physical Society (NESAPS). As in all Fulcrum events, the focus will be on developing teachers' content knowledge and shifting pedagogical classroom practice.

The theme is **Energy**! With funding from the National Defense Education Program (NDEP), we plan to provide twenty teachers with three full days of investigations, activities, and discussions. On the third day we will give each teacher a box of materials, all related to the topic of **Energy**. Because of the content and format of the course, priority will be given to teachers that have completed the Fulcrum Institute, but all K-8 teachers are welcome to apply. Details will follow in the next *Fulcrum Flash*.

NSTA National Conference

The National Science Teachers Association will hold its annual conference in Philadelphia on March 18-21, 2010. Three Fellows will attend the Conference with the Fulcrum Program Manager in order to become familiar with the latest science content, teaching strategies, and research.

Fulcrum's own Christina Ryan will be presenting a workshop entitled *Dripping, Flowing, Sinking, and Floating: Water Inquiries in Kindergarten.* She will share how her kindergarten students deepened their understanding about the properties of water through discussion, inquiry-based explorations, and science notebooks entries. She will also discuss the importance of formative assessment and documentation in the work of the early childhood science classroom. ***Congratulations, Christina!***

Christina Ryan, of the Cambridgeport Elementary School, helps her young students take a moment to focus on the day's activities.

Something to Think About

The "White Roof Movement" promotes making the roofs of buildings white instead of dark as a way of reducing energy consumption and greenhouse gas emissions. How would that work? Are there situations in which dark roofs might save more energy? How so?

Visit www.nytimes.com and put "White Roofs" in the search box to read more about this movement.

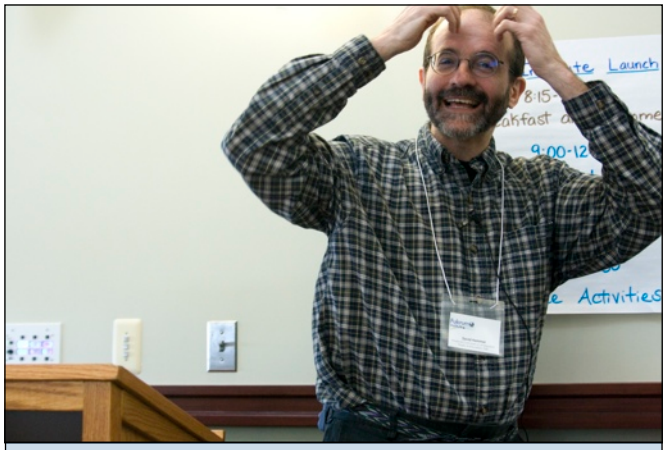
Formative Assessment and Probing Children's Thinking

A significant amount of a Fulcrum teacher's time is spent analyzing children's thinking. During the Summer Institute they researched the writings of pedagogical experts in the field. David Hammer, who will join Tufts as Professor of Education and Physics, was among the sources cited. For his report, Fulcrum participant Paul Power, who teaches 8th grade science in Natick, focused on the ideas students have on seasons. Paul referenced, Seeing the Science in Children's Thinking: Case Studies of Student Inquiry in Physical Change, "Hammer suggests that refining everyday thinking is the direction we should take... we need to construct new knowledge using the knowledge they already have. Students are not 'blank slates' and should not be treated as ones, but rather come to us with... skills that need refining."

In Course 2, each of the teachers interviewed one student during an investigation on heat transfer. The teachers were cautioned that the hard part of an interview is taking off the teacher hat, and the goal is to reveal ideas the child has, not change them.

At the January Launch, the participants were thrilled to listen to David present his findings on how children think.

After David's presentation, the teachers met in grade-level groups to compare their findings and process the understanding of how to interpret children's thinking. Teachers shared their analyses of the interviews about the temperature of spoons and discovered that from Kindergarten through to eighth grade, their students had a lot of ideas about heat!



David Hammer presented an engaging talk on Children's Ideas on Heat and Temperature at the January 23rd Launch.

WHAT DO CHILDREN THINK ABOUT HEAT? WHAT DO TEACHERS THINK?

Grades K-5

- Heat is tangible – a separate entity.
- Heat traveled up the metal spoon.
- Heat moves somehow.
- Hands warmed the spoon.
- Heat is like an eraser – it wears off on your hands.
- Metal would be colder than plastic.
- Slow particles are cold.
- Cold traveled up the metal spoon, but not the plastic.
- Cold and heat travel.
- Size and thickness matter (the larger spoon would get colder quicker because it was larger).
- Introduced condensation and knew thermal equilibrium.

Grades 4-8

- Metal is colder.
- Heat and cold are "matter" (bits).
- Air and/or water helps move heat.
- Material affects passage of heat and properties.
- Cold and heat travel.
- Size and thickness mattered – the larger spoon would get colder quicker because it was larger.
- Hot and cold are two different things.
- Different materials "hold onto" hot and cold in different ways.
- "Heat" is a thing that moves – it's a physical thing.
- Molecules are something that are discussed in the context of chemistry.

What the Teachers Thought

- We talk too much.
- Children try to connect new ideas to what they know.
- Children want to know if they are right.
- Are we too focused on students understanding vocabulary versus allowing them to learn by experience?
- Kids don't get enough science at a young age to develop a "science" mind.
- Students truly do hang on to prior misconceptions, despite new evidence.
- Students don't necessarily have command of scientific vocabulary.
- We have to become better questioners and not feel like we have to "fill in" the voids or silences with our explanations.

In the last issue we gave you 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 the container, could it float?

Is this situation different in any important way from a real hot air balloon?

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

For something to float, its average density must be smaller than the density of the fluid around it. So for the balloon to float, its average density must be smaller than the density of the air around it. Its density is its total weight (including the air inside it) divided by its volume. If it's sealed and rigid, neither its weight nor its volume can change, so its density can't change either, and it won't float even if it's heated.

Real hot air balloons are open at the bottom, so as the air inside the balloon is heated and expands, some of it is pushed out the bottom. The weight of the air inside the balloon decreases, just because there's less of it. Eventually the average density of the balloon and the air inside it becomes low enough for it to float.

The Fulcrum Institute for Leadership in Science Education is pleased to announce two events celebrating the success of the Cohort 3 Participants.

Completing the Fulcrum Institute is an amazing accomplishment, and we look forward to applauding our Participants on their perseverance and dedication.

Friday evening, May 14, 2010 ***Saturday, May 15, 2010***

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National Science Foundation
WHERE DISCOVERIES BEGIN