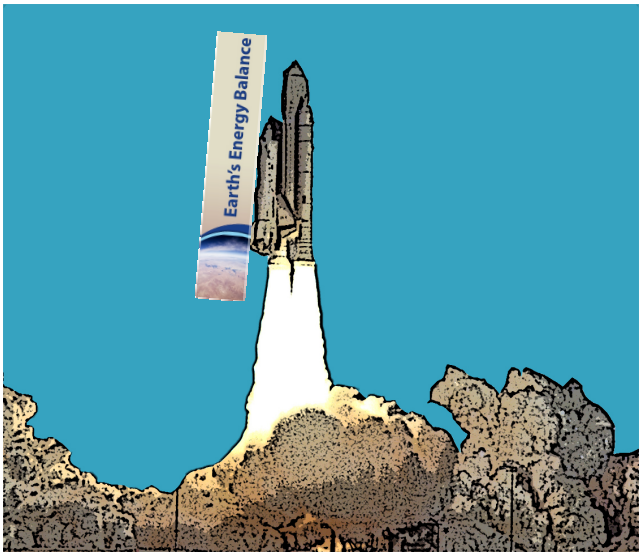
The Fulcrum Flash

Fulcrum Course Three Launch Considered A Success!



On Saturday January 26th, twenty-eight K-9 public school teachers spent the day at Tufts University sharing their learning from course two and launching themselves into the third and final course in the Fulcrum Institute for Leadership in Science Education, *Earth's Energy Balance*.

The morning began with presentations by two FI teachers, Laura Spangenberg from Shrewsbury, and Cynthia Nugent from Methuen. They shared how listening to their students' ideas about heat transfer has influenced their thinking about teaching and learning in the science classroom. This was a preview into the teaching goals of course three, in which teachers will build their understanding of formative assessment. They will learn how to make formative assessment an integral part of the learning and teaching process in the inquiry science cycle.

Fulcrum teachers then worked together to solve some challenges about spatial and temporal averages to prepare them for the final course in the Fulcrum series. The primary science goals of the final course, *Earth's Energy Balance,* is to understand the total energy balance of the Earth. The Fulcrum teachers will investigate this issue using physical models and scientific data from geographic visualizations, graphs, and satellite images to understand the contribution of factors that affect energy transport into and out of the global system. With climate change so prevalent in the news, teachers will gain an understanding of the physical systems involved in earth's energy balance.

In the afternoon, some school administrators joined their teachers for lunch and in small groups we had conversations about steps the teachers have taken in their schools to provide leadership in science education. A panel of three

Teacher Leaders, Pat Adams (Bagnall Elementary School), Darren Wells (Timilty Middle School), and Janice Lentine (Malden High School) discuss spatial and temporal averages.

administrators then shared ways in which teachers' ideas can help to shape professional development taking place at the school level. We were pleased to have principals and curriculum specialist join us from the Acton/Boxborough, Ashburnham/Westminster, Malden, Pentucket Regional, Shrewsbury, and Boston Public School Districts.

To see the online courses as a guest:
Go To: http://blackboard.tufts.edu/
Click on Course Catalog
Click Tufts Academic
Click School of Liberal Arts
Click Education
Click Fulcrum Institute

Branda Houle, Principal of Overlook Middle School in Pentucket Regional SD and Camille Colantuoni, Principal of Linden Middle School in Malden SD share their leadership ideas with Fulcrum teachers.

A Letter to Colleagues: Recruiting for the Fulcrum Institute; An Opportunity for All

As administrators who are fortunate to have teachers in our schools and districts involved in the Fulcrum Institute, we urge you to consider recruiting teachers in your schools for the Cohort Three of this highly successful initiative to promote teacher leadership in science.

On January 26, we were invited to be panelists and speak to the teachers participating in Cohort Two of the Fulcrum Institute. We were happy to support their continued development as teacher leaders of science in their respective districts. We came away from the experience hopeful that the work of these impressive and committed teachers can truly influence a more inquiry-based science approach in public education. Furthermore, these teachers are poised to develop a joy and wonder of science in their students that will continue to inform our teaching and learning throughout the next decade.

The work that the teachers are doing as Fulcrum Institute participants is truly amazing. Besides juggling all the responsibilities of being classroom teachers, they are taking the time to participate in the three on-line courses, share their data and inquiry in rich on-line discussions. They are learning to research their own development as practitioners through studying video of their classrooms. Through close collaboration with scientists from Tufts' Physics Department, they are developing their content knowledge of the particulate theory of matter and the many implications that has for understanding everyday phenomena such as heat, temperature, and, on the larger scale, global warming.

As school administrators, we are particularly impressed that the Fulcrum Institute also helps teachers to develop effective science teaching strategies that they implement in their classrooms and discuss with one another, as well as faculty from Tufts Department of Education and curriculum developers at TERC. We encourage them to continually find ways to share with their col-

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leagues the important ideas they are learning in the Fulcrum Institute. These ideas directly improve the quality of instruction their students are receiving every day. In just one year, these teachers are changing the perspective of teachers and students towards science in our schools.

In Shrewsbury, Fulcrum Teachers are meeting regularly with their colleagues to share strategies and lessons. We have also written and received a grant that allows us to have an after school program designed to give students the opportunity to experiment with some of the fundamental ideas in physical science that challenge 8th graders. The environment is less structured than their science class. We've been working on density (and the concept of homogeneity and scale), and the relationship between heat energy and particle motion. One of the Fulcrum teachers is co-teaching the program. In the Ashburnham/Westminster school district, the fact that Fulcrum Institute participants learn so much about collecting data and providing evidence has helped us develop professional development opportunities for teachers within their buildings centered around ideas and issues that are of concern to them. Our Fulcrum Institute participant has taken the lead in sharing ideas of inquiry-based strategies across all content areas. We have developed a plan for using substitutes to give teachers opportunities to learn with their colleagues and observe one another in their classrooms. In Malden, the Fulcrum Institute participants who teach in the PreK-K and K-8 schools have changed the way science happens across the district. Fulcrum teachers have influenced how science is taught at the high school level because students are expecting inquiry-based, data driven experiences that promote research and new questions. Across our three districts, we have continuous evidence of how the Fulcrum Institute has given our teachers the science content and leadership skills to make a difference for all our teachers and their students in our schools.

It is the reality and promise of our daily experiences with the Fulcrum Institute teachers that prompt us to urge all of you to recruit teachers for the next cohort who will begin studying the Fulcrum Institute courses in January 2009. The science lessons and teaching strategies in our schools are eloquent testimony to the power of this professional opportunity for your teachers. It is a professional opportunity that develops teachers as powerful intellectual leaders in science content and pedagogy. This intellectual capital serves to strengthen every aspect of the professional community in our schools. The Institute also helps to develop a strong cohort of administrators who can share effective school-wide and district-wide practices.

Please take a few minutes to learn more about the Fulcrum Institute by visiting the Fulcrum Institute online at http://fulcrum.tufts.edu, reading the Fulcrum Flash Newsletter, or talking with the Fulcrum Program Manager at (617) 627-3039. We are certain that once you explore the possibilities of the Fulcrum Institute for your school, you will be eager to recruit teachers from your building for this opportunity. We look forward to meeting you as Fulcrum Institute colleagues in January 2009!

Sincerely,

Camille Colantuoni, Principal,
Malden

Brenda Houle, Principal,
Ashburnham/Westminster

Mette Schwartz, Science Coordinator,
Shrewsbury

Teacher Leader Kara Frankian, from the Floral Street School in Shrewsbury, shares science leadership successes and challenges with her colleagues and Malden Public Schools, Director of Science and Health, Bob Sartwell

Leadership Perspectives: From the Eyes of the Science Supervisor

I was delighted to attend the "launch" for Course three at Tufts on Saturday, January 26. I was particularly impressed by both the explicit and implicit messages that resonated from the school administrators during the panel discussion that took place during the afternoon session. Each spoke of non-traditional ways that Fulcrum Institute participants can exhibit science leadership and foster improvement in science classroom practice in their school buildings. As the Director of Science and Health in the Malden Public Schools, I too am particularly interested in having the assistance of well-trained teachers of science content and pedagogy in my district to take on leadership.

However, as the panel members pointed out, this does not necessarily require teachers to leave their classrooms, nor does it mean for them become additional professional development providers for science only. There are a multitude of inconspicuous and powerful ways that Fulcrum Institute participants can promote positive instructional change by leading from their classrooms in their individual schools. Such practices include:

- Working with novice teachers to develop proven science teaching strategies.
- Providing content and pedagogical expertise to the building administrators and teachers.
- Being a liaison between classroom teachers and administrators.
- Offering ideas and suggestions to the school administrators about content and instructional methods that they have gained in the Fulcrum Institute.
- Opening their classrooms to others as a source of ideas for their peers.
- Developing and aligning classroom curriculum and practice to the local and state curriculum framework documents.
- Team-teaching or co-teaching science lessons.

All of these would be extremely helpful to encourage effective inquiry-based science in our schools.

Many building administrators do not have a previous educational background in the sciences. I share the panel's opinion that administrators want Fulcrum Institute teachers to help them foster interest in science. Because of the science content and pedagogical skills that teachers learn in the Fulcrum Institute, they can make a lasting and positive impact on science instruction in their school. Sharing your love and enthusiasm for science through your classroom practice and professional conversations are invaluable contribution to district practice.

Dr. Robert T. Sartwell, Director of Science and Health, Malden Public Schools

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Learning to Listen to Children

In the Massachusetts Science and Technology/ Engineering Curriculum Framework, there are two guiding principles that address formative assessment: Guiding Principal IV states: "An effective program in science and technology/engineering addresses students prior knowledge and misconceptions." Guiding Principle VIII states, "Assessment in science and technology/engineering serves to inform student learning, guide instruction, and evaluate student progress." To address prior knowledge and guide instruction, teachers must find out what children already know about key concepts. Teachers do this by asking the thoughtful questions and then listening to the carefully to the students' ideas. This is an essential form of **formative assessment**.

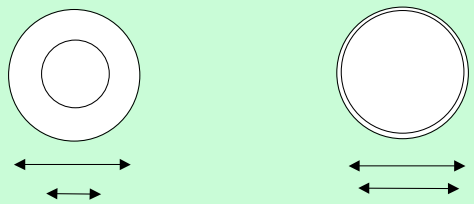
Here is a vignette that illustrates how attending closely to the ways in which children explain the world around them offers a window into their thinking.

TEACHER: Here are two spoons, one metal and one plastic. Feel them.
Is one hotter than the other or colder than the other?
FOURTH GRADER: No.
T: Here are two glasses of ice water. I'm going to put each spoon into a glass of ice water. What do you think will happen?
FG: They're going to get colder.
T: Do you think one will get colder than the other?
FG: I think the metal spoon will get colder.
T: Why?
FG: Because the cold waves from the water will come up the spoon and try to break out at the top.

Listening to this interchange prompts dozens of questions.
Does the youngster think cold travels in waves?
Is a wave a one-time event like a tsunami or a periodic series of events like ripples on a pond?
Are there heat waves as well as cold waves?
If the cold waves "break out" where will they go?
Does the cold wave weigh anything?
When it escapes from the spoon, does the spoon get lighter?
Is the child using the phrase "cold wave" because he thinks that there is some sort of wave, or is he using the phrase "cold wave" because that is a phrase he hears when he listens to the weather report on television?

Children have wonderfully inventive ways of making sense of the world around them. If we learn to listen and probe, there is much we can learn about how our students learn, and in turn, about how we can effectively teach.
Excerpt from Laura Spangenberg's interview of a student about heat transfer

Solving a Circumference Mystery or the Pizza and the Pantheon



Here are two scale drawings.

On the left, diameter of inner circle is 1 foot and diameter of outer circle is 2 feet. Outer circle is 0.5 feet away from inner circle everywhere.

Circumference of inner circle is π x 1 feet = 3.14 feet (approximately).

Circumference of outer circle is π x 2 feet = 6.28 feet (approximately).

Circumference of outer circle is 3.14 feet longer than circumference of inner circle.

On the right, diameter of inner circle is 100 feet and diameter of outer circle is 101 feet. Outer circle is 0.5 feet away from inner circle everywhere.

Circumference of inner circle is π x 100 feet = 314 feet (approximately).

Circumference of outer circle is π x 101 feet = 317.14 feet (approximately).

Circumference of outer circle is 3.14 feet longer than circumference of inner circle.

It doesn't matter how large or small the inner circle is – if the outer circle is 0.5 feet away from the inner circle everywhere then the circumference of the outer circle is 3.14 feet longer than the circumference of the inner circle. We could be talking about a circle as big as the equator or the period at the end of this sentence.

Something to Think About

How do the "record high" and "record low" data differ from the "average high" and "average low" data?

How do you think the "average high" and "average low" data were calculated?

What is the justification for joining the data points with smooth lines in the case of "average highs and lows? In the case of record highs and lows?