

The Fulcrum Flash

Another Successful Fulcrum Summer Institute

The Tufts campus was full of energy as our largest group yet of Fulcrum teachers joined us for a full schedule of activities July 13th- 17th. One participant sums up the week with a thoughtful letter written soon after;

Dear Fulcrum Institute,

I wanted to write to tell you what a fantastic experience I had last week as part of the Fulcrum Cohort 3 summer session. Each day was jam packed with exciting and interesting pieces of science and technology. I was fascinated by all that we accomplished and learned. I was able to speak with scientists and colleagues to learn a different aspect of science and think in new ways. The experiments were definitely things I could do with my third and fourth graders, and I got some new ideas from others. The leadership breakout session was very productive for the teachers from Shrewsbury. We decided to meet to pull together a presentation for our new Assistant Superintendent discussing what we have done

and learned at Fulcrum and how we hope to incorporate science more into the ELA aspect of our day. We were exhilarated when we left.

On another note, what I also love about the Fulcrum experience is that everyone I work with at Tufts is supportive and helpful. It was a very, very big step for me to do this. I have always been intimidated by science to the point where I would try and team with other colleagues so I could teach social studies and they would teach science. Well, no more!! Thanks to the encouragement and support every step of the way by the Tufts/Fulcrum organization I feel confident to try new things and explore a world I had found so scary before.

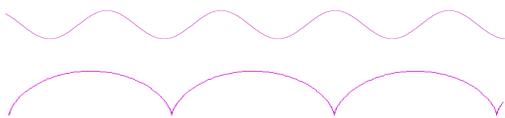
Lastly, the week was completely organized, stress-free and totally productive. Going to "summer school" is always a daunting task, but you made it a truly valuable and enjoyable experience. Thank you for everything.

*Sincerely,
Helene Bisceglia
Floral Street School*

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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?



Principal Robert C. Harrison of Pentucket joins in the investigation.



National Science Foundation
WHERE DISCOVERIES BEGIN

Cohort 3 and Goldilocks Investigate Heat and Temperature

This semester, Fulcrum's Cohort 3 teachers are investigating heat and temperature. They are using probes to measure temperature change as they explore heat transfer in the environment around them. In the weeks to come, they will tell stories of heat in their lives as they untangle the contributions of different modes of heat transfer and sort out the conceptual distinction between heat and temperature.

When Goldilocks finds three bowls of porridge at different temperatures in the bears' house, she accurately assesses the situation and comes up with one of the most recognizable lines in children's literature, "This porridge is too hot; this porridge is too cold; aahh, this porridge is just right!"

Dr. Sandy Buczynski, assistant professor in the MSTE Program at the University of San Diego in California, shares an interesting idea made across the curriculum.

Goldilocks' famous line is a perfect lead-in for an **inquiry** with upper elementary students that explores the concept of heat energy as measured by temperature. In the investigation, students may consider the variables that might account for temperature differences between each bear's porridge. For example, if Papa Bear has the hottest bowl of porridge, does he also have the largest bowl size? I've conducted this inquiry with groups of fifth and sixth graders and also with preservice students with good results. It's fun to observe students as they make surprising discoveries (e.g., a quantity of porridge in a smaller bowl will retain heat energy longer than a large bowl with the same quantity of porridge) and start considering that Papa Bear's bowl could have been the smallest bowl on the table.

To obtain a copy of the five-page report, contact Carole at Fulcrum. To further the discussion, contact Dr. Buczynski sandyb@sandiego.edu.

The Flash Changes Slightly We decreased the font and shrunk the photographs in the Flash in an effort to become greener. The result is a slimmer Flash, but hopefully no less interesting... Another change is the color; this and future editions will take on the Tufts' school colors of brown and blue. **Go Jumbos!**

Underwater Robots to Visit

Remotely Operated Vehicles, using the physics of buoyancy and electrical wiring, will be the focus of a two-day workshop presented by SeaPerch on October 23rd - 24th at Tufts.

SeaPerch, created by the MIT Sea Grant College Program in 2003, trains educators across the United States and around the world to build SeaPerches.

A SeaPerch is a remotely operated underwater vehicle, or ROV, made from PVC pipe and other inexpensive, easily available materials.

After the training, the teachers will be able to work with their students to build their own SeaPerches and deploy them on voyages in nearby bodies of water.

Fulcrum teachers will be able to apply what they have learned thus far with Fulcrum because of the Physics of buoyancy and electrical wiring. Additionally, teachers that have not gone through the Fulcrum Institute are invited to attend, and this will provide a nice introduction to the Fulcrum Family.

If interested in participating, contact Carole at Fulcrum. There is a limit of 20 teachers, so do not hesitate to call!



A Completed ROV

Involving Families in Science

Family Science is an informal science education program that gives parents and children an opportunity to work and learn together. Hands-on activities that use easy-to-find, inexpensive materials let families explore the ways in which science plays a role in daily life.



Originally inspired by the Family Math program from EQUALS at Lawrence Hall of Science, Family Science strives to involve those typically underrepresented in science education through activities that touch on the history of science and the scientific accomplishments of people from a variety of backgrounds. If there is interest, future editions of the Flash may include an activity from the Family Science book.

Fulcrum has copies of the Family Science book, with 200 pages of engaging, hands-on activities, created to introduce families to the fascinating world of science. Contact Carole Bersani at Fulcrum if you would like to borrow a copy. Additionally, if you would like to host a Family Science Night at your school, please contact Carole at Fulcrum for assistance.

The Summer Institute *continued*

The Summer Institute was fortunate to have a variety of guests attend our talks and workshops. From Tufts, Provost Jamshed Bharucha, Dean Lynne Pepall, and Director of Public Relations Kim Thurler.

There were also guests from Fulcrum administrators; from the Overlook Middle School in Ashburnham, Principal Phillip Saisa and Assistant Principal Sandra Rehler joined us for a good part of the day. Principal Anthony A. Gasbarro came from the Glenwood Elementary School in Wachusett to support his teachers and learn some science, and Principal Robert C. Harrison of the Helen R. Donaghue School in Pentucket also partook in the science learning and exploration.

In addition to our esteemed team of Tufts physicists, Judah Schwartz, Roger Tobin, Gary Goldstein, Bill Waller, and Hugh Gallagher, and the TERC curriculum specialists, Sue Doubler, Sally Crissman, Sara Lacy, and Lisa Miller, we had additional experts in the field share their knowledge.

We were pleased to host Isa Zimmerman who is a strong advocate for the

presence of STEM Education in the state of Massachusetts. Ms. Zimmerman was a Senior Fellow at the UMass Donahue Institute through the President's Office.

Marianne Wiser, associate professor of psychology at Clark University, presented an insightful talk on conceptual changes in children, students, and the history of science.

Mette Schwartz, the middle school Math and Science Coach for the Medway Public Schools, presented a talk on how to become a science leader within the schools and districts.

Joel Blackmer, Cyndy Nugent, Pat Adams and Nancy Wile, the Fulcrum Fellows, were present as mentors for the cohort of Fulcrum teachers. Having successfully completed the entire Fulcrum Institute, their presence at the Institute was invaluable to our teachers.

On the last day, Tufts doctoral student Brian Gravel led activities on various methods of exploring equilibrium, as shown in the photographs on the right. Our teachers demonstrate that learning about science can be fun!



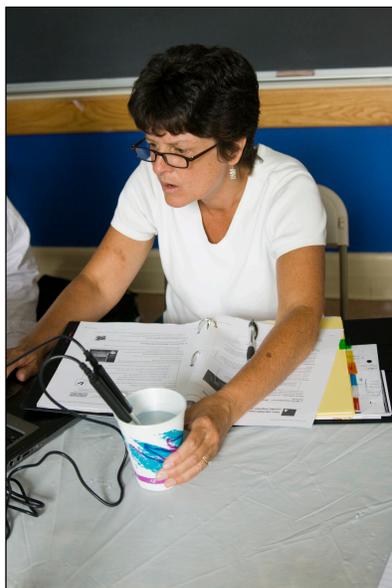
Luis Arroyo attains equilibrium on the Slack Line



Jason Young challenges Newton's first Law on an exercise ball.



Sue Doubler assists Kristof Mar as he explores heat transfer.



Kathy Ells tests the temperature of an egg using probes.



Cyndy Nugent and Jane DeLeire help Lynette Provencal find her balance.

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



A bug by the name of Mindy Minute is stuck at the end of the 6 foot long minute hand of a giant clock. A second bug, Homer Hour, is stuck at the end of the 4 foot long hour hand of the same clock.

As the clock moves they are sometimes as close as 2 feet to one another and sometimes as far away as 10 feet from one another.

Homer claims that from noon to midnight they are 2 feet away from one another 12 times. Mindy claims that from noon to midnight they are 2 feet away from one another 11 times.

Do you think either is right, or are they both wrong? Why do you think so? Can you sketch a graph of how the distance between Mindy and Homer varies over that 12 hour period?

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

Mindy and Homer are two feet apart when the hands coincide. There are two ways to go about finding out when this happens:

- 1) Take a clock or watch, set it at noon and manually move the hands noting each time the hands are on top of one another. It happens at noon and again at 5.45 minutes after 1, at 2×5.45 minutes after 2, 3×5.45 minutes after 3,... and finally at 11×5.45 minutes after 11.
- 2) You can do some simple algebra. Call the time elapsed after noon until the hands coincide T . In this time T , the hour hand has moved through an angle of $\text{Angle}_{\text{hour hand}} = 360/12 \times T$ [the hour hand takes 12 hrs to go around once]

Because during that time the minute hand moved through an angle of $\text{Angle}_{\text{hour hand}} + 360 = 360/1 \times T$ [the minute hand takes 1 hr to go around once], this means $360/12 \times T + 360 = 360/1 \times T$.

Therefore, $\text{Angle}_{\text{minute hand}} = \text{Angle}_{\text{hour hand}} + 360 = 360/1 \times T$.

$$\text{Or } T/12 + 1 = T \quad \text{Or } 1 = 11/12 \times T$$

$$\text{Or } T = 12/11 \text{ hr.} = 1 \text{ hour and } 5.45 \text{ minutes}$$



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