

The Fulcrum Flash

Air Takes Up Space in the 2nd Grade

Kelly 2nd graders writing on the daily word splash



(Names of children have been changed.)

On a frozen Friday morning in February at the Floral Street School, Mrs. Kelly's Room was warm, bright, and welcoming for her students. Her Shrewsbury second graders are referred to as "The Kellys." Some of her students were reading on the couch. Some were sitting at tables pointing excitedly to pictures in a book and wondering why hammerhead sharks had such an odd-shaped head. Other children were aware of the "Word Splash" of the day that Mrs. Kelly had written in the middle on the large chart.

They busily wrote their responses on a sticky note and then added their sticky note to the

paper. The word of the day was "Air." Their responses were splashed back all around the word: "Oxygen;" "Greenhouse gases;" "Water;" "Carbon Dioxide."

While the children occupied themselves with books or talk, Mrs. Kelly answered children's questions and listened to their

The importance of creating classrooms that are "warm, bright, and welcoming" for students has been underscored by research that uncovers the connection between student engagement and learning and positive relationships between teachers and their students and families. Students of all ages and stages report how eager they are to learn new ideas from teachers who take the time to get to know them. Classrooms become intellectually welcoming of all students when they are places that welcome the ideas of those students. The Word Splash activity allows The Kellys to express their ideas about air in a relaxed context.

Something to Think About

You walk once around a 5 mile track at a speed of 3 miles per hour. How fast would you have to run a second lap around the track so that your average speed for the two laps is 6 miles per hour?



ideas. She has known her second graders for two years, having taught them as first graders. Floral Street Schools use a looping model that allows teachers to form

deeper relationships with the children and their families.

After the morning announcements and the Pledge of Allegiance, the Kellys circled around Mrs. Kelly, who was sitting next to the easel with the “Air” Word Splash. Mrs. Kelly asked the

understanding about air, its components, and its connection to living beings.

After Mrs. Kelly laid the foundation to enable her students to connect to their prior knowledge, she held up a clear plastic cup and a paper towel. She

get in, they are not flat, so I think that the paper towel will get wet.”

Mrs. Kelly: “You’re thinking the shape of the cup has something to do with it?”

Hannah (nodding her head yes): “Like the edges.”

The Kellys tested their ideas. Water spilled and papers got splashed. More paper towels were handed out. Small hands pushed cups upside down into the water. Cups were tilted under the water and the 2nd grades saw bubbles escape.

After experimenting, the Kellys came together again to

The Inquiry Model promoted by the Fulcrum Institute courses begins with the notion that students should learn to express their “prior knowledge” of science concepts and phenomena before embarking on learning new content. This implies a deep respect for the knowledge that students have gained through their observations of the world in both formal learning situations and at play.

children gathered around her to explain why they had written their words.

The first eager student explained why she had written evaporation, “I wrote evaporation because water goes up to the clouds and when it rains it makes the trees grow bigger and that makes the trees grow more stronger and then we can get more air.” Abby explained why she had written “oxygen,” “Trees give us

asked, “If a cup with a paper towel in it is put upside down in the bowl of water, will the paper towel get wet? I want you to do your thinking first. Turn to your partner and share your idea.”

After a few minutes of explaining to their friend what they thought might happen and why, Mrs. Kelly asked for friends to share their ideas.

Matthew: “It won’t get wet

The Inquiry Model encourages students to make predictions. Making predictions can be a powerful learning ritual in any classroom, PreK – graduate school. The pair-share ritual which these looping first and second graders use to “do their thinking” and share their initial predictions builds an intellectual climate in the classroom and allows them to begin their explorations as scientists do...sharing conjectures without judgment words like “correct” or “Not possible” ...relying instead on discussions with colleagues before engaging in intriguing experiments.

The Inquiry Model encourages students to share their ideas and talk about how they connect these ideas to form an understanding of their world. As the children in Mrs. Kelly’s class are encouraged to explain why they wrote the words they shared on the Word Splash, they give voice to concepts that shape a scientific understanding of the world. When students begin their science study with their own ideas, they become personally interested in the lesson, eager to explore their ideas and the ideas of their peers in new activities and experiments.

oxygen. We breath air.” And Samantha said, “I wrote geenhouse gases because gases are part of the air.” Mrs. Kelly asked Emma, “Why did you write “water?” Emma answered, “There is moisture in air.” It was apparent that these 2nd graders already had some emerging scientific

because if you have pressure of air when you set it [the cup] on the water, the water gets pushed away and it doesn’t have water in it.”

Hannah: “I think the paper towel will get wet because when you’re facing it down the edges are rounded so it [water] can

share their findings. The Kellys had observed that if you put the cup upside-down and straight, the paper towel would stay dry. Ava explained, “There was too much air for any water to get in it.” Olivia connected the air in an



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WHERE DISCOVERIES BEGIN

upside down cup to a favorite movie, “The air was all over the paper towel and it had been all over the cup...Just like the movie Jack Sparrow, they went under water with a boat (motioning with her two hands as if pulling a boat over her head) and they didn’t get no face wet.”

Mrs. Kelly asked to hear from other students about what they found happened when they tilted the cup under the water. Joshua noticed when the cup was straight in the water, that the air was trapped. Then when he tilted the cup, “the air escaped from the cup and bubbles came out of the water.”

“Joshua, what evidence did you have the air was escaping?” asked Mrs. Kelly.

Joshua responded, “ Bubbles came out of the water. Water can’t just make bubbles because when

you jump into a pool you see bubbles and water come out cause you’re coming down with air. And you have to breathe and sometimes you make bubbles

when you breathe.”

Another student explained, “The water replaced the air that was going out.”

“What evidence do you have that tells you the water replaced the air?” Mrs. Kelly asked.

“Cause the bubbles came out!”

Ashley added, “When the cup was tilted, not much air could get into the cup and so the air couldn’t push the water out of the way so lots of water got in and got the

paper towel wet.”

Jacob summed up the learning for the class, “There’s air in the cup and when you release the air, the water takes its place.”

Mrs. Kelly repeated his words, “The water takes its place. I like that explanation. The water takes its place.”

These eager young scientists are learning to rely on “evidence” to further their understanding of complex scientific phenomena. A phrase like, “What evidence do you have...” requires a student to reflect on their observations and experimentation to decide whether or not the process has confirmed their prediction. The Kelly Scientists are developing a vocabulary for science as well as the habits of mind of skilled researchers, which will lead them to new and deeper understanding of this stuff called air that takes up space and creates bubbles when confronted by a stuff called water.

A Week in the Life of a Fulcrum Teacher: Managing Time in an Online Course

After the bell rings to signal the end of the final day of the school week, a Fulcrum Institute Teacher’s week has just begun. Friday is the first day of the week for the online Fulcrum Institute course, *Some of What Matters About Matter*. On Friday, the new session for that week is posted online. The session may be dedicated to the pedagogy of science, or it may be dedicated to investigating a specific phenomenon of the physical world. Either way, the Fulcrum Institute Teacher knows their *Fulcrum* workweek has just begun!

Fulcrum Institute teachers from Boston, Shrewsbury, West Newton, Fall River, Acton, Somerville, Lynn, Natick, Ashburnham, Wareham, Beverly, Groveland, Methuen, Holden, and Malden, Massachusetts go online each Friday to open up their new learning session. They begin by reading the

weekly announcement, and printing out the new assignment. On Friday, March 16th, when Fulcrum teachers opened up Session 8 and read the announcement, they found out that they would be designing an object that would sink in one liquid and float in another.

Sometime during that weekend, FI teachers found time to design their “Float *and* Sink” objects. They were told they could use any objects they found- whether from the kits that the Fulcrum Institute provided, or from around their house. Nancy Wile, a 5th grade teacher at Dr. Elmer Bagnall School in the Pentucket Regional School District, used a rubber band to join a small porcelain rabbit to a block of paraffin. She managed to get this object to *sink* in water yet *float* in corn syrup:

"I calculated the density of the combined figures by measuring their combined mass (24g) and used water displacement to figure out the volume (20.5 cc). I then calculated the density (24 g/20.5 cc) at 1.17 g/cc. I then figured that it would sink in of the liquids except the honey and corn syrup. I used water to keep it simple and the bunny sank as expected.

I then tried the honey because it seemed like it should work. It came close where part of it was floating but not all of it so I used the corn syrup to have it float. This combination worked."



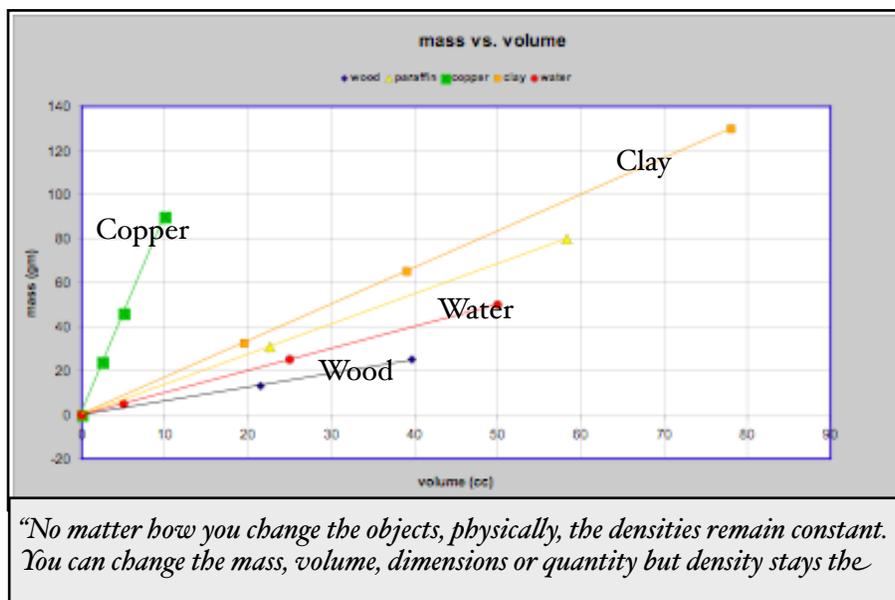
Bunny and paraffin float in corn syrup.

Nancy and the other FI teachers were able to design their special sinking and floating objects due to the experiences they had in previous sessions- learning about the density of solids and liquids. They had already collected density information about several kinds of liquids such as water, alcohol, vegetable oil, and corn syrup. They had used the water displacement method to find the density of such materials as copper pipes and nails, wood cubes, and modeling clay. They had graphed all of these volumes and masses on an Excel spreadsheet and had learned or, as MJ Busby, 8th grade science teacher in Beverly, put it, "No matter how you change the objects, physically, the densities remain constant. You can change the mass, volume, dimensions or quantity but density stays the same."

By Sunday night, teachers are asked to post a prediction about the phenomenon that they are considering. By Tuesday they are asked to post a report of their scientific outcomes to their online discussion forum. In these reports they are expected to report data they have collected, and support any claims with evidence. Between Tuesday and Thursday they are expected to read each other's reports and provide critical feedback that leads to collaborative

learning. The 34 current teachers participating in the Fulcrum Institute are in peer teams distinguished by colors. They will work in these teams for the entire semester. These teams of 4-6 teachers have developed a strong sense of community and an appreciation of the power of inquiry.

For many teachers, this is the first online course they have experienced. They have not only had to learn the content of the course, but they have had to learn the seemingly technological wizardry of navigating Blackboard, the virtual classroom environment, attaching files, using Excel spreadsheets, working with data tables, and creating their own home-page. Some teachers, snagged with computer issues as they scramble to get their work posted, post a "Help!" Message in the Help! Forum, "On my lap top , no message box is available to type in. I get the subject line, the menu bar, the attachment line.... but no message box and no way to write a message." The Fulcrum Institute staff provides technical support over the phone and in person, so that teachers don't waste time struggling with computer issues, but can use their time to share their science explorations.



"No matter how you change the objects, physically, the densities remain constant. You can change the mass, volume, dimensions or quantity but density stays the

By Thursday night, the FI teachers have spent a week investigating a scientific phenomenon. They have used materials and scientific equipment, they have made predictions, written a report, posted their report online, and reflected on what they have learned. They have shared their ideas, questions, and insights with colleagues in "discussion forum" of the

online environment. With the support of skilled facilitators and thoughtful peer moderators, a common conceptual framework emerges from the week's work.

The teachers have many questions relating the phenomenon they investigated. Tufts University physics professors involved with the Fulcrum Institute ponder those questions and skillfully encapsulate the most salient concepts into a response to the teachers the following week.

FI teachers, learners in the virtual classroom, are ready for some time to digest all that they have learned, but inevitably, Friday follows Thursday, and the Fulcrum Institute Week begins anew.

Fun Conversions

- 1 trillion microphones=1 megaphone
- 2000 mockingbirds = two kilomockingbirds
- 10 cards=1 decacards
- 453.6 graham crackers=1 pound cake
- 8 nickels=2 paradigms
- 1 millionth of a fish = 1 microfiche
- Time between slipping on a peel and smacking the pavement =1 bananosecond

From Robin Jorgensen, FI Teacher, Cohort I

TEACHER LEADERS IN THE MALDEN PUBLIC SCHOOLS

As a component of a comprehensive model for urban school reform, the Malden Public Schools is placing an increased emphasis on the concept of differentiated roles for teachers and a subsequent increase in the development of leadership roles for classroom teachers. Historically there has been a sharp demarcation between the role of classroom teacher and that of the role of a formal leadership position. If a teacher had a desire to move into a position of leadership in the district he or she had to have a plan that included acquiring a license for a formal leadership position and leaving the classroom for full time work in school administration.

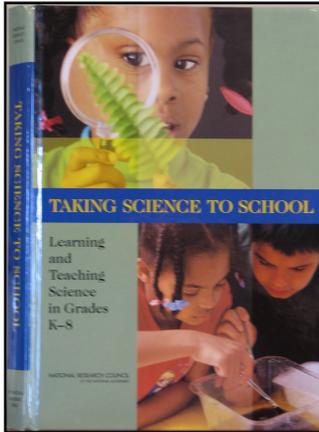
Over the course of the last six years school administrators and union officials have worked together to craft both opportunities and contract language to support those opportunities for teachers to take on increased opportunities for leadership and voice in important areas of the life of the schools and the school system. Every school has a Leadership Team which consists of a number of teachers who participate in decision making at their school. There is a District Steering Committee made up of teachers and administrators who assist in leading and guiding the school reform efforts.

The Malden Public Schools are extremely fortunate to be a partner with Tufts in the Fulcrum Institute. Selected elementary teachers are having the opportunity to receive rigorous training in hands-on science as well as leadership training to coach and assist their peers in developing their skills in teaching high level, interesting science lessons to their students. There are currently plans going forward for a Teacher Leader in Science at Malden High School as well as Science Teacher Leaders at the PK-8 schools. Teachers who have participated in the Fulcrum Institute will be well positioned to take on new roles on leadership in Science across the district.

Changing instructional practice in a challenging urban school environment is complicated work which requires a united effort among all school and district staff. Teacher Leaders in the Malden Public Schools know that their work and their voices are valued, trusted and critical to moving our school district forward on behalf of all of our students.

by Joan Connolly, Superintendent of the Malden Public Schools, and Co-PI of the Fulcrum Institute

Hot Off the Press!



National Research Council (2007). *Taking Science to School: Learning and Teaching Science in Grades K-8*.

Washington, D.C.: The National Academies Press
Taking Science to School, a new book from the National Research Council, is one we recommend adding to your professional library.

The book synthesizes the most current research and thinking about how K-8 students learn and practice science.

Many of our ideas about science learning are changing or becoming more nuanced. What do children who are proficient in science do? *Taking Science to School* reports they:

- know, use, and interpret scientific explanations of the natural world;
- generate and evaluate scientific evidence and explanations;
- understand the nature and development of scientific knowledge, and
- participate productively in scientific practices and discourse

The book shares suggestions about how we can help children develop these proficiencies.

For more information and access to the executive summary see the following National Academies' site: http://books.nap.edu/catalog.php?record_id=11625

CALENDAR

May 4th: Fulcrum Family Night, Museum of Science

May 11: Last day of Course I

July 9-13: Fulcrum Summer Institute

