# A TIME for Physics First

Academy for Teachers
Inquiry and Modeling Experiences for Physics First

Leadership in Freshman Physics, 2009-14

NEWSLETTER: Vol 7, No. 3, December 2013

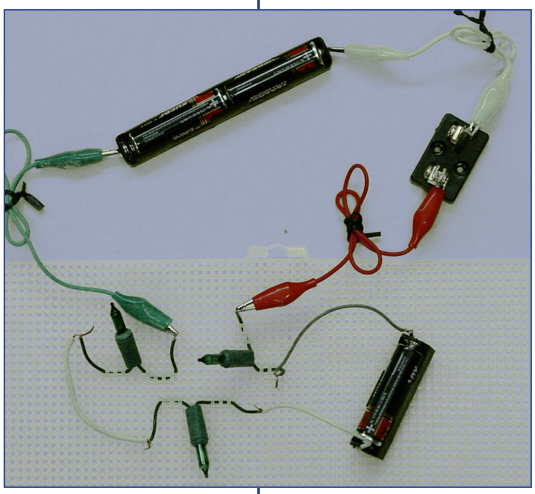

## Third Time Really IS the Charm!


Christina Brands, Portageville High School


This is my third time teaching electricity, and I am still AMAZED at what this curriculum does for my students. I was doing the Bulb, Battery, and Wire lab with my second hour class one day in September. For those of you who haven't taught Electricity in a while, this is the lab where you give your students a flashlight bulb, a piece of wire stripped on both ends, and an AA battery. The only instructions they get are to get the bulb to light using what they have. The Pre-Lab discussion has the students draw diagrams of arrangements they think will work and arrangements they think will not work. I always test my bulbs and batteries out before giving them to my students to prevent the "the bulb and/or battery don't work" comments.

My second hour class is a medium class; it has some special educations kids with some average kids, not the kids at the top of the class. It took them about 15 minutes to figure out how to get the bulb to light. Usually one group gets it, and the other groups "cheat" off that group. They have to come up with four different arrangements to get the bulbs to light and draw pictures on their labs.

While some of my students were working on getting their pictures drawn, something happened that has never happened before. Without prompting (or permission, but it was OK), I had kids that were finished getting with other groups adding batteries to the circuit. They figured out the bulb would get brighter when they added batteries. This started a competition of who could build the "best circuit." We had circuits with two bulbs, one battery, and two wires; circuits with three batteries and one bulb; circuits with two bulbs, two batteries, and two wires, etc. They were constantly calling me over to show me what they had made. I made reference to this lab constantly while teaching Electricity because they learned about circuits, current, voltage and resistance that day without even knowing it. I had never gotten this response from this lab. It was one of those great teaching moments.



This is one of my favorite labs in the Physics First curriculum because it gives students a true sense of science. They get both the frustration of trying to figure out a problem for themselves and the joy that comes with figuring out the problem for themselves. I set up this lab this past spring for a school board presentation about Physics First. They loved it!!

One final note – the superintendent's son is in my second hour class and was one of the ones leading the "best circuit" charge. He loves the labs we do!! I don't know any better way to promote Physics First sustainability in my district than that!

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# The Evaluators' Corner

## Assessment Resource Center

The Physics First Evaluation Team at the Assessment Resource Center (ARC) is pleased to introduce its newest member, John Christiansen.

Before coming to ARC, John worked several years as an environmental consultant in Columbia, where he currently resides with his wife and two young daughters. John has a bachelor's degree in biology from Westminster College in Fulton, and a master's degree in environmental engineering from Texas A&M University. John is also a graduate of Glendale High School in Springfield, where he took physics with a former Physics First fellow. John has a strong professional interest in data management and analysis, and is excited about applying this interest to his new role as a member of the Evaluation Team for this project.

*Welcome aboard to John Christiansen!*

John is currently working with the student content knowledge pre-tests, so if you have not yet sent in your students' pre-tests, please get them to us ASAP. While our Evaluation Team leader, Dr. Christi Bergin, has been spending the semester in Chile as the spouse of a Fulbright scholar, the rest of the team has been collecting, sorting, cleaning and analyzing Physics First data.

For evaluation purposes, Fellows are divided into two groups; the larger group consisting of ALL Physics First Fellows. This group provides us with most of the program evaluation information, including the student knowledge pre-tests and post-tests. There is also a subset of that group, which has additional data requests, which we refer to as the Evaluation Group. This group is comprised of Fellows in districts that were not involved in the previous Physics First grant. This Evaluation Group also has a survey to administer to freshmen and seniors in their building/district. By questioning these students, we are trying to determine if students whose teachers are Physics First Fellows develop more positive attitudes toward STEM class content than students of comparison teachers. Preliminary results are promising. Students of Fellows had significantly more positive attitudes about science than the comparison group. This suggests the intervention may be effective in improving students' disposition toward science and to increasing future prospects of taking more science courses and having a career in science. More data needs to be collected and analyzed before we can make more substantial predictions. We greatly appreciate the help of Fellows in the evaluation districts in gathering consent forms and administering surveys for this part of the evaluation.

The data for the preliminary report included 451 freshmen of 26 teachers in the 2011-2012 academic year. We are currently working with the data collected throughout the 2012-2013 academic year. There are 940 freshmen and 1306 seniors from the same districts. We will not be surveying freshmen this academic year; however, seniors in the evaluation districts will be surveyed both this academic year and the next academic year, when our original freshmen will be seniors. Packets of Senior Surveys will be distributed to schools in late January. Please encourage your seniors to participate.

And thank you to all Physics First teachers for collecting the data that helps evaluate the strengths of the program and suggests ways it can be improved.


*To contact Christi Bergin, Paula McFarling, Bridget Murphy and John Christiansen:*

*Assessment Resource Center 573 882-4694 or muARCresearch@missouri.edu*

# Who me? Yes YOU! Becoming Teacher Leaders

Nilay Muslu, Dr. Deborah Hanuscin and Somnath Sinha

University of Missouri

At this year's STOM conference, research team members Somnath Sinha and Nilay Muslu helped facilitate a panel session on leadership along with Fellows Kathy Ray, Mike Hall, Rachel Kenning and Elizabeth Dyer. This session enabled these Fellows to share their experiences, the process of being leader, and for our team to challenge a few myths about leadership.

After first sharing information about A TIME for Physics First, we gathered the audience's thoughts about leadership and activities in which leaders participate. We explained one of the main goals of the project was creating leaders who would become advocates for excellence in mathematics and science. Not surprisingly, some of the audience members held the same myths that many of the participants in our program held initially about leadership:

Leadership requires a formal title or position.

Not everyone can be leader.

Leadership occurs outside of the day-to-day responsibilities of teaching.

Our four panelists then described how their understanding about being a leader changed through participating in the program.

As Mike explained, he initially thought one needed to be *assigned* as a leader. Leaders, most usually, were the ones with the important titles and big offices. Since he didn't have a big office or an important title, he admitted that he hadn't seen himself as a leader. Throughout the project, his ideas about leadership changed through discussions about leadership and reading his colleagues' blogs. He said that now he recognizes, "As teachers, we lead every day - and that leadership takes on many different looks."

Elizabeth mentioned she used to think, "leadership was being in charge of something." She believed that leaders have titles, the responsibilities and the headaches. Now, she believes, "Teaching can benefit from flexible leadership in which different teachers step up to take charge of different projects or different requirements of the organization. I can be a leader when I have the knowledge, drive and vision." Elizabeth emphasized that different people may be capable in different ways, and so sometimes she leads, and sometimes she allows others to lead.

Rachel reflected on her experience as well. "I used to think that only a select few teachers should be our leaders." She questioned, "Who am I to be a LEADER?" Like others, her ideas also changed throughout the project. Fulfilling her action plan goal of giving a presentation at a conference made her realize that she had something valuable to offer. "Now I know that you don't have to be the best to have something to offer. We all have talents and abilities in different areas. I have something to contribute." She described leadership as a 'mindset' and explained how this has changed her personal life positively as well.

Kathy described herself as a shy person, and thought leadership was for type A personalities. After a while, she thought, she realized that leadership means "having a desire to support your colleagues and seek to improve the effectiveness of the educational system." Therefore, leadership requires collaboration and communication. This realization affected her and she shared how she was now more comfortable getting "out of her shell" and talking in front of a crowd.

While each of these teachers' leadership journeys might easily sound like just good teaching, what distinguishes their efforts is a sense of empowerment—a belief in their own capabilities to make a difference within and beyond their own classrooms. Through this, each of them has been able to reach out in ways that affect not only their students, but also their colleagues and their communities.

We're excited that our session "Who Me? Yes, You! How to Become a Teacher Leader" has been accepted for presentation at the April 2014 NSTA Conference in Boston. We look forward to helping other teachers recognize the leader within!

# Spread the Word - Sustain Physics First

Mike Hall, Jefferson City Public Schools

With our Physics First involvement coming to an end, many Fellows are asking the question, "How do we sustain Physics First in our district?" Here is how we are answering that question in Jefferson City.

We are in a unique position this school year. With Brie Roberts taking a position at our alternative school before last year and Matt Stacey moving to one of our middle schools as an assistant principal, I was the only Physics First Fellow in our building. And this year, I am not teaching classes, instead serving as a mentor and instructional coach, hosting two teachers from the MU Fellows program. Luckily, Matt hosted a SMAR$^2$T intern who we hired to replace him and I had an MU student teacher, who is now one of my Fellows. So even though no one from our summer academy training is teaching in our building, I feel good about our Physics First team and confident that we are teaching it the right way. What follows is some advice that has seemed to provide some stability and sustainability for us at Jefferson City.

*First, make sure you have building and district-level support*. Invite the key people in your district into your classes or have them sit in on your department meetings. Make sure they are informed about Physics First and why it's different than the classes you've taught before. Our district was fully behind the program from the first time they heard about it. In fact, they came with us to Columbia to observe some Physics First classes at West Junior High School during the spring before our first summer.

*Get the word out about Physics First in your classrooms.* Most local papers are always looking for pieces about the schools. In Jefferson City, we have a media summit where we can go pitch our ideas to the local media. It led to an article in the local paper during our first year. We also did some professional development in our building on whiteboarding and invited teachers into our classrooms to see what we were doing. Another thing we did was create a student video, where we interviewed students and asked them what they liked about the class. This gave us something we could use during open house, parent teacher conferences, or registration nights.

*Hire wisely.* I know that most of us don't have much say when it comes to hiring decisions, but lobby for teachers who aren't afraid to change or try something new. In my opinion, they don't have to be an expert in physics, they just need to be willing to learn and follow the Physics First instructional model. In fact, last year we hired Karen Pullen, a biology teacher who had never taught physics. She loves teaching Physics First so much that she turned down a biology job at our high school. "The way I teach now is completely different from the way I used to teach. We work in groups, begin a lesson with exploration through labs, students stand in front of the class daily and explain things to each other, and we have discussions and debates about topics on a regular basis. The classroom is more student-centric, rather than teacher-centric."

*Work as a collaborative team.* We are a PLC school, so collaboration is supposed to be a big part of what we do. Each teacher in our department has a voice and is an active participant on the team. We have collaboration time each week in which we share best practices and try to adjust what we do to make it best for our kids. It also serves as an accountability tool to some degree. We each know what the others are doing in their classrooms. Because maybe the most important thing you can do is use the Physics First curriculum and pedagogy with fidelity - don't take bits and pieces and try to make it work. If other teachers in your building are trying that, you've got to get them on the right track.

*Spend time planning quality training for new teachers.* If you can get release days early in the school year, use them. We've been given release days each year since we started the program, except this year. On those days, we went through the curriculum step by step, pointing out things we really liked or others that we have tweaked a little. We talked about the Physics First pedagogy, read a couple of articles on whiteboarding, and then spent some time practicing it. In our building, whiteboarding is a huge part of what we do, so we felt we needed to cover it thoroughly. "I think the most difficult part for me was learning what questions to ask while white-

boarding," says Julia Tolksdorf, a first year teacher in our building. "It was difficult because I would try and steer the students into coming up with the right answers, but I didn't want to just give them the answers! I struggled initially thinking of questions to ask."

Sustainability is something we should all think about as we move through this school year. As teachers move into and out of our districts, there are bound to be some challenges in keeping Physics First intact. These challenges will vary from school to school depending on size, among other things. But, luckily, we have a network of teachers around the state that we can rely on to help guide us through those changes.

*Michael Hall, Jefferson City Public Schools, receives the Science Teachers of Missouri 2013 Science Teacher of the Year award from STOM President-elect, Betsey O'Day.*
*Congrats, Mike!*

*Middle row from left,*
*Meera Chandrasekhar explains graphing on Logger-Pro; Sara Torres and Ann Willenmeyer cooking something up; John Willenberg and his famous Hovercraft*

*Left, Sunder Balasubramanian and Joe Burkemper listen during a conference session.*

*Right, Glenn Owens during his conference presentation*

# Stake Your Claim: Helping Students Engage in Argument from Evidence in Your Classroom

Jaimie Foulk, Mentor; Rachel Kenning, Parkview High School

What do you envision when you think of argument in your classroom? For some, the thought of asking students to argue might seem unpleasant at best, unproductive or even intimidating at worst. At the annual STOM meeting in October, we led a session on just this topic, and we asked classroom teachers to consider the benefits of engaging their students in argument.

### Why Argument?

"Engaging in Argument from Evidence" is important in the science classroom, because it represents an activity that is authentic to science. As such, it is one of the eight Science and Engineering Practices woven into the Next Generation Science Standards, which are built upon a primary goal of science education to *produce scientifically literate citizens.* Rather than simply training future scientists (and neglecting the rest of the population) or preparing students to take standardized tests (and overlooking whether they truly understand scientific ideas), the activities in your classroom can help *every* student to participate in authentic scientific practices that increase their scientific literacy, and *engaging in argument from evidence* is one place to start.

### How Should Argument Look?

During our session we asked participants to share their initial thoughts about argument and its potential role in their classrooms. They expressed several great ideas, but one of the most informative was the distinction between *argument* and scientific *argumentation*. While casual use of the word "argument" may carry a negative connotation in everyday vernacular, its meaning in science education is more strictly defined.

To illustrate this, we presented participants with a murder mystery scenario called "Slip or Trip," (originally from Hillocks, 2011, and adapted from the Wheeler-Toppen webinar). Participants read a narrative description with an accompanying image (see Figure 1, below) and shared their reactions in small groups.

***Fig. 1. "Slip or Trip?"***
*At five-feet-six and a hundred and ten pounds, Queenie Volupides was a sight to behold and to clasp. When she tore out of the house after a tiff with her husband, Arthur, she went to the country club where there was a party going on. She left the club shortly before 1:00 am and invited a few friends to follow her home and have one more drink. They got to the Volupides house about ten minutes after Queenie, who met them at the door and said, "Something terrible happened. Arthur slipped and fell on the stairs. He was coming down for another drink—he still had the glass in his hand—and I think he's dead. Oh, my God—what shall I do?" The autopsy conducted later concluded that Arthur had died from a wound on the head and confirmed that he'd been drunk.*

Next we asked them to complete three tasks:

1) make a **claim** about what happened,

2) identify **evidence** to support the claim, and

3) present their **reasoning** (see Figure 2, page 7).

In other words, they engaged in scientific *argumentation*. Using this scaffolded approach, each group constructed and shared their unique argument. The result was a lively and productive discussion that allowed for expression of various ideas, changing of positions and—much like science—awareness that those ideas could not be proven, but rather, merely supported.

### Where is the Argument in Physics First?

Some good news for Physics First teachers regarding this NGSS practice is that the PF curriculum is designed to give students frequent opportunities to engage in this three-step process of argumentation. Each time they explore a big idea at the beginning of a unit (for example, "energy is conserved" or "objects in free fall accelerate"), you can ask them to make claims and provide evidence and reasoning about what they experience. When they complete a lab in the middle of the unit to explain a concept (for example, "constant velocity" or "Newton's Third Law"), again they can make claims, provide evidence and link them together with reasoning. Anytime they whiteboard a framing question or solve

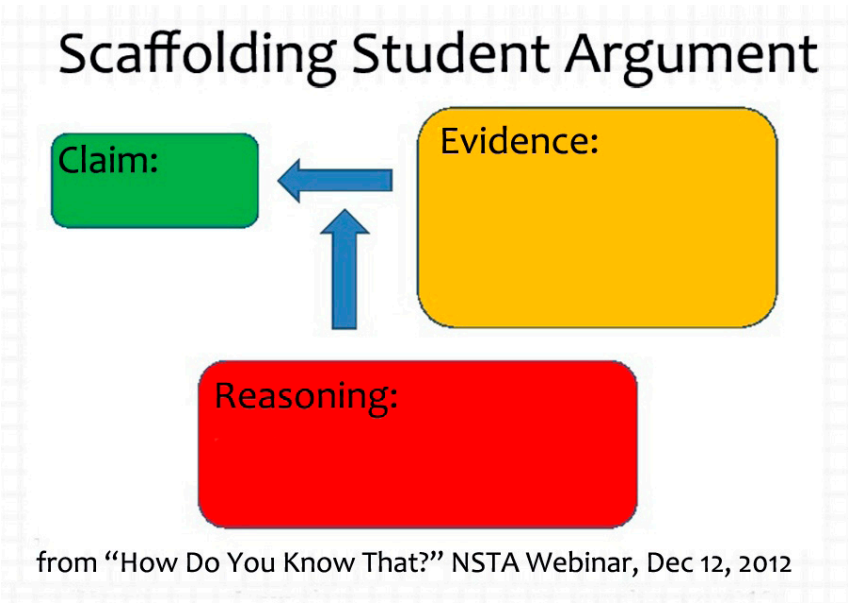



*Figure 2 shows the steps taken to facilitate classroom argumentation.*

a practice problem, a teacher has the opportunity to ask students to make a claim, provide the evidence, and explain their reasoning. As their ideas change, so can their arguments; the key is that they use evidence and reasoning to support their new ideas.

Asking your students to engage in evidence-based argumentation on a regular basis can provide them valuable opportunities to become adept at this scientific practice. As a result, they can move farther along the path of scientific literacy, and your classroom can be NGSS-ready!

References:

For more on implementing argumentation in your classroom, NSTA offers these helpful resources, including both webinars and corresponding .pdf handouts:

Joe Krajcik, Michigan State University, leads an NSTA webinar on Engaging in Argument from Evidence:

learningcenter.nsta.org/products/symposia_seminars/Ngss/webseminar11.aspx

Jodi Wheeler-Toppen, NSTA Press, leads an NSTA webinar on Helping Students Write about Claims and Evidence: http://learningcenter.nsta.org/products/symposia_seminars/NSTA/webseminar16.aspx

Hillocks Jr, G. (2011). Teaching Argument Writing, Grades 6–12.

National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.


*Left; Deb Hanuscin, Gloria Gammel and Ryan Carlton having a discussion, or, are they engaging in scientific argumentation? Right, Jaimie Foulk, co-author for this article, presenting.*

# Reflections on Whiteboarding

Andrew West, Mentor; Lisa Grotewiel, Keytesville High School;
Melanie Utterback, Community R-6 High School

For anyone who has been involved in A TIME for Physics First for any length of time, using whiteboards in the classroom is probably as second nature as putting on shoes in the morning. Who knew that this simple item, once relegated to kitchen bulletin boards and college dorm rooms, could be so useful on one hand and so frustrating on the other? *Why won't the green markers fully erase with anything other than the $30 a bottle Expo cleaner? Why is it that some of the markers end up smelling like stinky feet? How is it that students can create Picasso-like doodles but can barely draw motion diagrams?* And yet, we know deep down that there is something special about these little white boards. There's something amazing about seeing our student's ideas come to life through pictures and words and diagrams and about hearing them justify and explain their ideas to their classmates.

One of the interesting things we have noticed about whiteboarding as we have watched each other teach and reflected on that instruction is how we oftentimes use whiteboards so differently. Is it really possible to use a marker and a whiteboard in ways that are significantly different? As we have thought about this question, we believe the answer is yes. We believe that there are at least two qualitatively different approaches to using whiteboards.

### Using Whiteboards as a Formative Assessment

Formative assessment is, by its very namesake, intended to form, or shape, our instruction. Formative assessment reveals something to us about student understanding that we can use to make decisions about the next steps in our lesson. So, what does it look like to use whiteboarding as a formative assessment? Consider the following scenario:

*Melanie's class has finished collecting data from the tumble buggy lab. Melanie asks each group to construct a graph presenting the distance and time data that they collected. Melanie does not provide explicit directions about the type of graph to use or how to label each axis. After students have completed the task, Melanie asks the groups to come to the front of the room and share their graphs. Two of the groups have created bar graphs. Melanie asks these groups to present first. As the groups are presenting, Melanie asks:*

*Can you tell me about your decision to use a bar graph?*

*What are some of the things you know about bar graphs that helped you decide to use them instead of some other type of graph?*

*What are some of the strengths of bar graphs?*

*What are some of the weaknesses?*

*As students respond to the questions, Melanie writes the big ideas that support their explanations on the chalkboard in the front of the class. Next, Melanie asks another group to present their whiteboard. This group has decided to use a line graph. Melanie asks the same questions as before, only this time the questions are focused on the student's decision to use a line graph, and as before, these ideas are summarized on the class chalkboard. Melanie then leads a class discussion based on the ideas on the chalkboard, directing the class to the idea that although both types of graph could be used, perhaps it makes more sense to use a line graph in this case because the students have continuous data.*

This scenario highlights the benefit of using whiteboarding as a formative assessment strategy. From these interactions, Melanie learns what students know about selecting between different types of graphs, why they make the choices that they do, and the mechanics behind how they actually construct graphs. Additionally, Melanie is able to use the student's ideas to make a case for using line graphs and is able to lay a foundation for graphing that can be used for the rest of the year.

### Using Whiteboards as a Summative Assessment

In contrast to formative assessment, the goal of summative assessment is to determine what students have learned and understood at the end of a sequence of instruction. It might be at the conclusion of a single topic, or at the end of unit, but in all cases, it occurs at the end of instruction. Consider the following scenario:

*Lisa's class is a couple of days away from taking the uniform motion unit test. In preparation, students are assigned 15 practice problems. When the students enter class on the next day, Lisa assigns each group a practice problem to put on their whiteboards and share out. As students share their answers to the*

*rest of the class, Lisa responds:*

*Nice job. You got that one right!*

*That one's not quite right. I think you missed a decimal point.*

*It seems like most of you have this!*

*After the students are finished presenting, Lisa reviews the format of the test and answers any questions the students have.*

This scenario highlights the benefit of using whiteboarding as a summative assessment strategy. From these interactions, Lisa has a sense for how the class, overall, is doing with the content and is aware of how well individual students understand specific types of problems. Students have also had the chance to review for the test and to ask questions.

### Is One Approach Better than the Other?

You might be tempted to think that one approach to whiteboarding is better than the other. However, as we have thought about it and experimented with the differences in our own classrooms, we believe that both approaches can ultimately be very helpful. The difference hinges on your goals for using whiteboarding. Is your goal to diagnose student ideas during instruction with the intent to use those ideas to propel your instruction forward? If so, we suggest you use a formative assessment approach. If, however, your goal is to gain a summary of what students have learned, then a summative assessment approach might be for

*Andrew West, PF Mentor and co-writer for this article.*

# Passing The Praxis

## Christina Brands, Portageville High School

After the first few days of the Advanced Physics track classes during the Summer 2013 Academy, I was confident that I could pass the Physics Praxis. Then came the electromagnetism unit!! It was pretty much downhill after that. I struggled nightly with the concepts and the homework, and Google® became my best friend. If you had asked me at the end of the two weeks if I thought I would pass the Praxis, the answer would have been a very loud NO!!

After being home from the summer academy for a few days and settling in, I thought I would try the practice exam. After all, I had learned a great deal over the two weeks from Dorina, Karen and Meera; surely, something stuck!! I did horribly on the practice exam. I didn't even come close to passing it. So I had two choices: cancel my August 1 date for the Physics Praxis or use my six weeks and buckle down. I chose the second option.

My summer reading became Knight, Jones, and Field's *College Physics* text. I studied one hour a day, five days a week. I read Chapters 6-30 in the *College Physics* text (I don't remember even coming close to reading an entire textbook in college). Something I would definitely suggest to my fellow Fellows is the "Stop to Think" questions in the text; they are largely conceptual and similar to the type of questions on *Mastering Physics* and the Physics Praxis. Something else I focused on was relationships between variables and equations. This was suggested by Chris Goll during the Advanced Physics classes during the summer and was extremely helpful to me. I only missed one week of studying during the six weeks because I was at the AP Chemistry Institute and was focusing on that content. The week of the test I spent several hours a day reviewing.

Finally, August 1 arrived. I took the test at SEMO, which is an hour drive from my home. I had a nice breakfast on the way up, had a nice drive singing at the top of my lungs, and a little prayer. I took the computer-based version, which I also suggest. After you submit your test for grading, you get a raw score, so you pretty much know right then whether you passed or not. I had forgotten the score for passing for Missouri (141), so I rushed out to my car and grabbed my phone to look it up after the test. I was beyond excited!!

Good luck to my fellow Physics First Fellows!! I hope I have provided all of you with some useful insights.

Congratulations to you, Christina, from the PF Team!

# Follow-Up Meeting with STOM Conference - Your Opinions

Sarah Hill, Dept. of Physics and Astronomy, University of Missouri

Overall, the first Follow-up meeting of the 2013-14 academic year, held October 5 in conjunction with the Science Teachers of Missouri (STOM) fall conference in Columbia, was a success according to those who participated in the online survey.

Thirty-three Physics First participants completed the survey that asked your opinion of the combined format, what changes could be made, what you would keep the same and the likelihood of you continuing to attend the STOM conference in coming years after the Physics First project has ended. We also asked a few more questions related to sustainability.

Of the 33 respondents, two were C1 Fellows, 25 were C2 Fellows and five were Mentors.

**Tell us your overall opinion of the conference-within-a-conference format for the Oct. 5 Follow-up meeting held in conjunction with the annual STOM conference.**

"I liked the format. I attended both days in order to make the most out of the conference."

"My opinion is very positive. The format allowed us to have individual and group experiences."

"I thought it was good because we got to go to sessions we were interested in. Being a teacher in a rural area, I teach multiple subjects and I thought it was awesome that we could attend non-physics sessions while also hitting up some good physics ones as well."

"The conference was very rewarding. The sessions were useful and informative. In my opinion, it was some of the best sessions I have attended. The time to meet with the other PF fellows worked out great."

"The meetings conducted by PF fellows were some of the best PD I've ever attended because they were practical and not based on theory."

**What changes would improve the overall experience?**

More and better vendors, and especially book vendors

Better keynote speaker

Better "advertising" by STOM to get the word out

More non-PF presenters

More presentations about the PF curriculum and pedagogy

Enough PD is enough PD – too much at district level already

Improve details at venue – provide access to presenters prior to event, so that all technology can be checked, iron out bugs.

Offer presentations more than once

*Left, Chris Goll offers techie advice to Sheryl Madden and Elizabeth Dyer. Center, Joe Pistone in contemplation. Right, Elizabeth Dyer asks a question during a presentation.*

**What would you keep the same?**

All of it, keep the venue, the set-up, everything

Teacher-led presentations

Flexibility of scheduling, able to go to any presentations.

All aspects of PF presentations, workshop format, keep STOM/PF together.

**And, since this project's funding is completed in August 2014, we wanted to know about the likelihood that you would continue to attend the STOM conferences in the future.**

Eighteen of the 33 surveyed said maybe, that depends on other variables, six said very likely, five said probably, three not all likely, and one didn't know.

**What are the variables that would increase the likelihood that you might attend future conferences?**

Most of you want great topics in the presentations, great invited speakers, free registration and free stuff. Others said that travel time was an important factor, making location a significant consideration.

**Great presentation topics was the factor most often picked, and the subject areas that would pique your interest cover a wide range:**

Information that would enhance student understanding and engagement

Anything Physics and Chemistry or nature of science

Classroom demos, tools, lesson plans, assessment plans, classroom management ideas, how to build things like a hovercraft and actually build it that day

Any current topics - whatever that happens to be at the time

A program on classroom behavior issues would be good.

More specific ones on modeling, more on engineering

Pedagogy relating to Physics First curriculum, whiteboarding, Socratic dialogue

Creative uses of manipulatives

Investigative class projects

The next few questions addressed your use of social network sites and your opinion about how that media might facilitate ongoing communication among Fellows after the project has reached the end of funding.

**We asked "Would networking among Physics First project members be better supported by the use of social media?"**

Nineteen said no, and 14 said yes. Fifteen said they use Facebook, one uses YouTube and 12 do not use social media.

**We also wondered what science or science education blogs, if any, you might follow, other than those on Sakai.**

Three reported that they frequently read such blogs, five said frequently, but 25 said they rarely do. Of those who do, the blogs cited were by NSTA, SLAPT and NASA.

Thank you to each of you who took the time to complete this survey. Your responses help inform and inspire the PF management team future decision-making.

*Left, John Willenberg explains his Hovercraft design.Top, center; Melanie Utterback and Lisa Grotewiel, right, during their presentation on Whiteboarding. Bottom, center, Angie Parkes discusses a worksheet during a conference session.*

# Brain Benders

Sarah Hill, Dept. of Physics & Astronomy, University of Missouri

### Throw the Ball

How can you throw a ball as hard as you can and have it come back to you even if it doesn't hit anything, there is nothing attached to it and no one else catches or throws it?

### Water in the cup

A man in a restaurant asked a waiter for a juice glass, a dinner plate, water, a match and a lemon wedge. The man poured enough water onto the plate to cover it. "If you can get the water on the plate into this glass without touching or moving this plate, I will give you $100," the man said. "You can use the match and lemon to do this." A few minutes later, the waiter walked away with $100 in his pocket. How did the waiter get the water into the glass?

### Opaque marble balls

Lost in the woods, you come upon a mysterious stranger who hands you two large spheres made of two kinds of opaque marble. The spheres look the same, are the same size and have the same weight and apparent density; however, one is solid and the other hollow. The hollow sphere contains a tiny map that will enable you to navigate your way home. Unfortunately, you cannot break the spheres. The stranger agrees to open the sphere that contains the map only if you can determine which sphere is hollow. How do you determine which sphere is hollow?

## Answers to August 2013 Brain Benders

### Hourglass on a balance

An hourglass is being weighted on a sensitive balance, first when all the sand is in the lower chamber, and then after the timer is turned over and the sand is falling. Will the balance show the same weight in both cases?

*Answer:*

From the instant the first grain of falling sand strikes the bottom of the hourglass to the instant the last grain of sand leaves the upper chamber, the force resulting from the impact of the falling stream remains constant and helps make the total weight equal to the weight of the hourglass before inversion. When the stream of sand begins to fall, the freely falling sand does not contribute to the weight, so there is slightly less weight registered for the first few hundreds of a second. As the last grains of falling sand strike, there is a short time interval when the weight exceeds the initial weight. For each grain of sand now striking the bottom, no longer is there a grain of sand leaving the upper chamber, so the hourglass weighs more.

### Balancing an upright stick

Generally speaking, bodies with low center of gravity are more stable than those with high. For example, a stub of a pencil can be stood on its flat end very easily, but it is much harder to stand a long stick on its flat end. Paradoxically, however, a long stick with its higher center of gravity is much easier to balance on the tip of a finger than a short pencil. Why?

*Answer:*

The statement that bodies with low centers of gravity are more stable applies only to situations involving static equilibrium. Under these conditions, a very small tilt from the upright position will move the vertical line of the center of gravity outside the contact area of the base producing a net torque about a horizontal axis. Therefore the taller stick falls over easily compared to the short pencil stub that needs a larger tilt. When balancing the stick on the tip of a finger, the finger can be moved to keep it underneath the center of gravity of the stick. The longer stick has a greater moment of inertia, so its angular rate of turning is smaller than for the shorter stick. You therefore have enough time to move your finger back under the center of gravity before the stick falls over.

### Sailing in Calm Air!

Suppose you are adrift in a sailboat on a river and the air is absolutely calm everywhere. The river is flowing at 4 knots, but you wish to reach your dock downstream in the least amount of time. Should you raise the sail or leave it? Will there be a difference?

*Answer:*

Raise the sail and the wind created by the ship's movement with the

current will help push the boat forward. You cannot sail directly into the wind, but must sail a zigzag course against the headwind, just as sailboats normally do.

### Child with a balloon in a car

Inside a moving automobile, a child holds a helium balloon by a string. All the windows are closed. What will happen to the balloon as the car makes a right turn?

*Answer:*

The air inside the car will tend to continue its straight line motion momentarily, so the air pressure inside the car will be slightly higher on the outside radius of the turn. The balloon will then be pushed to the right, toward the inside of the curve.

### The laundry line revealed

Why does laundry hung on a clothesline dry from the top down?

*Answer:*

The most obvious explanation – that gravity draws the water down and out of the fabric – is incorrect. The water in the fabric is held in place in the spaces between the threads of fabric by electric forces and the gravitational force cannot dislodge this water. The slow evaporation of water into the air next to the garment cools this contact air, which is now more dense than the surrounding warmer air. This more dense air moves downward across the face of the cloth, and the moving air soaks up the evaporated water molecules, becoming even more saturated as it sinks. The uptake of water vapor will be greatest at the top and less farther down because the more saturated the air becomes, the less its ability to soak up water molecules. So the garment dries from the top down.

*From upper left, going clockwise;*
*Marvin Allen in his presentation "Energy Across the Grade Levels." Mike Hall spreading the word about sustaining Physics First. John Gilbert; Ellen McCray, both enjoying a session; Sarah Hill and Tandi Steffens in the lunch line; Julie Purcell and Dorina Kosztin.*

# Reach for the Stars - National Rocket Competition

George Allan, North Kansas City High School

My students were so inspired by the story of Homer Hickman in the movie "October Sky" last year that they asked me, "Why don't we shoot off some rockets?" At that time there was no funding in place to capture this enthusiasm by my students. This year I was determined to offer the opportunity to my students to participate in the "Reach for the Stars - National Rocket Competition."

The National Rocket Competition is held in honor of the first teacher in space, Christa McAuliffe. The theme line for the event is "Reach for the Stars." As you may know, Christa McAuliffe was tragically killed in the 1986 Challenger space shuttle explosion at the Kennedy Space Center in Orlando, Florida. The state winners of each rocket launch competition are awarded a trip to the Kennedy Space center for the national competition.

I have 140 students in my physics classes; and for every 12 students I needed $170 to purchase the rockets for the learning experience and competition. The plan for our students was to build the rockets and shoot them off in the competition. We needed to purchase 12 sets of rockets at $170 per set, which was a total of $2,040.

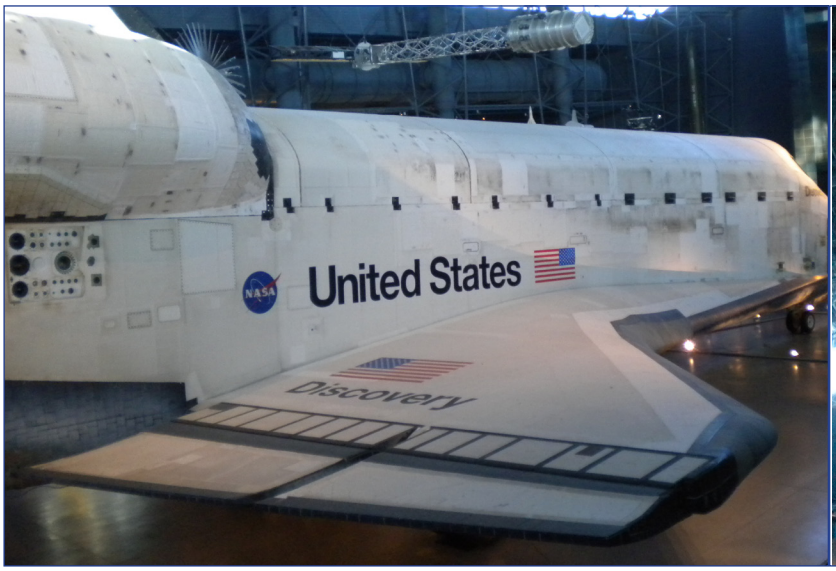

We were able to purchase six rocket sets along with a launcher for the rockets. Through fund raising efforts on my part, we were able to build a fund of $1020 for the rockets. Donations came from all sources. We received $200 from my barber, $500 from Mr. Bob Hiatt and the NKC Education Foundation, $150 from my department chairperson, Dr. Lanett Jauss, and I contributed $170 of my personal funds.

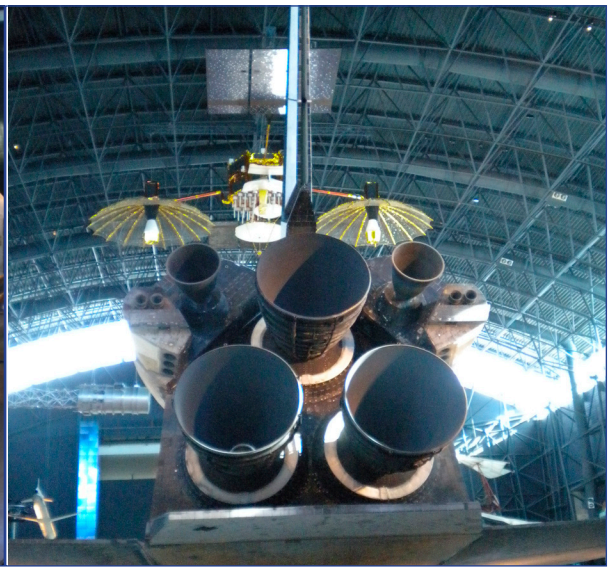
My students stayed after school to build the rockets and we purchased cool T-shirts for our competitors.

All of the students who built their rockets launched them in the National Rocket Competition on November 2, 2013. A winner and runner up to the competition were crowned. The winner, Anthony Roberson, will be attending the national competition at the Kennedy Space Center in 2014. Eldonna Rose, a Physics First fellow served as a backup judge for this event.

The rocket building and launching complemented our two-dimensional motion /projectile motion unit. Participation in the National Rocket Competition event grew from our study of the Projectile Motion study unit in October of each year. We view the inspirational movie "October Sky" as a part of the Projectile Motion unit each year.

Next year we plan to get a better handle on the funding and expand the National Rocket Competition.



*Left, the Discovery and right, its rockets, both photos at the National Air and Space Museum, courtesy of Meera Chandrasekhar.*


*More fun at the Follow-up meeting / STOM Conference:*
*Top left, Michael House participating in a conference session. Center, Cathy Dweik creating a list during a session.*
*Top, right, Somnath Sinha during a presentation by the PF research team.*
*Bottom left, Sheryl Madden makes a comment during a session.*
*Below, right; The vendors who attended the STOM conference*

**Fast Facts:**

Grant period: September 1, 2009 - August 31, 2014
Funding Agency: National Science Foundation
Target Participants: Ninth grade science teachers in Missouri school districts
2012 summer academy:
Cohort 1: June 4-June 15 2012
Cohort 2: June 4 - June 29, 2012
Math Teacher academy: June 4-8
Adminstrators academy: June 7-8, 2012
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*Ann Neubauer, all dressed up for her STOM conference presentation, "Halloween Physics, A Fun Day of Demos!"*

From:
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