

A TIME FOR PHYSICS FIRST

ACADEMY FOR TEACHERS
INQUIRY AND MODELING EXPERIENCES FOR PHYSICS FIRST

LEADERSHIP IN FRESHMAN PHYSICS, 2009-14



NEWSLETTER: Vol 4, No. 2, August 2010

A TIME for PHYSICS FIRST

...HERE'S WHAT HAPPENED

Meera Chandrasekhar, MU

The 2010 Physics First summer academy took place in Columbia June 7-July 2. The management team, teaching assistants and teaching team spent several weeks getting ready - but things really kicked into high gear the week before the academy. The teaching team spent three grueling days sorting out what would be taught when, which problems we'd use for homework ...all that good stuff! The SMARTboard arrived three days before the academy - and then the scramble was on to figure out how to use it! Luckily for us, we had great help from expert Fellows whenever we fumbled!

All the preparation paid off. We had a very successful Physics First academy. It was intense - but a lot got done. Our Physics First Fellows learned a lot (that's what pre- and post-tests tell us). We look forward to a successful academic year.

The Physics First Team would like to thank all the participants and helpers. We had 36 Physics First Fellows from 19 school districts across Missouri. Eleven math teachers attended the Math academy (June 14-18) and 14 administrators attended the Administrator academy (June 17-18). The teaching team consisted of 10 personnel - university faculty, peer teachers and teaching assistants. The administrator academy was led by the incoming and outgoing school district co-PIs. The support staff includes the project director and two undergraduate assistants. Including the evaluators, we had 77 individuals involved! And that's not counting our guest presenters.

We are gearing up for summer 2011 - we expect to have nearly twice as many people involved!

PHYSICS FIRST FELLOW OPENINGS

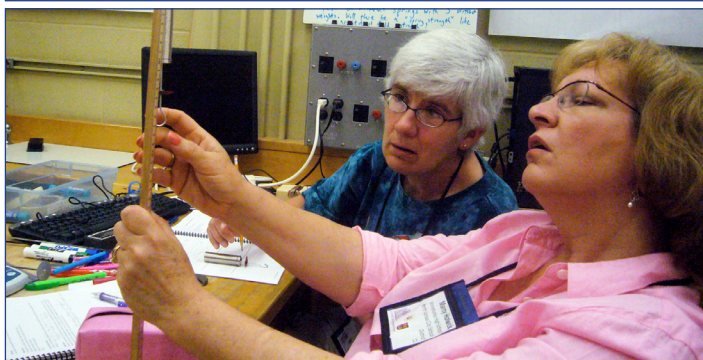
A limited number of spots are available for Cohort 2.

Application deadline: Jan 11, 2011

visit www.physicsfirstmo.org

TABLE OF CONTENTS

| | |
|---|---|
| ...Here's What Happened | 1 |
| The Math Academy - June 2010 | 2 |
| Meet our new School District co-PI... .. | 3 |
| Feedback from the Administrator Academy | 4 |
| Reflections: the Next Generation | 5 |
| Brain Benders | 6 |



THE MATH ACADEMY - JUNE 2010

The letters below were written by teachers who attended the math academy. The letters are written to math teachers who were unable to attend. The purpose was to provide insight into the collaborative effort expected in implementing Physics First in their districts.

I am very excited about the Physics First program. Rarely do we, as educators, get to go to professional development that allows us to learn so much content and makes our lives easier simultaneously. Not only will our collaboration allow math teachers to help the science faculty, but the students coming through this program will be much stronger mathematically. I work well with my collaborating science teacher, and am excited to help her. However, I am a little selfish in that I know Physics First is going to dramatically increase our students' algebra skills and performance in math tests. I really recommend you see what it is all about.

The first and most important aspect of your "job" is to have an open dialogue with the Physics First teachers. This is a two-way street... math can help and support the sciences but the work done in Physics First will also help the students make those connections they need and strengthen their math skills.

One major way to assist the physics teachers is by using examples where math content lines up with science. You don't have to switch your entire curriculum around. Making small changes in the order and merely using some common terminology will help.

Eleven mathematics teachers attended the Physics First Summer Academy during the week of June 14-18, 2010. The teachers who attended had the opportunity to:

- familiarize themselves with parts of the Physics First curriculum by attending and actively participating in the Physics First course, alongside their science teacher colleagues;
- discuss the implications for the mathematics curriculum of the Physics First course, including the differences in terminology and notation used in the Physics First class as compared to those used in mathematics classes;
- brainstorm with their mathematics fellows about how they can help in the implementation of the Physics First curriculum in a manner that allows strengthening both mathematics and physics curricula;
- establish an on-going collaboration and an open dialogue with their science colleagues;
- deepen their mathematics content knowledge and increase their problem solving skills through completion of word problems related to physics content.

-- Dorina Mitrea, Professor of Mathematics, MU

Dear math teachers supporting Physics First,

My week at the Physics First institute has been very insightful and educational. It would serve you well to attend if possible.

I was made aware of the trap that math teachers fall into thinking of the independent and dependent variables as always being x and y , respectively. Instead we need to remember that any variable can be used to represent the independent and dependent variables, and we need to be sure to reinforce that with our students.

Another thought I had during this week is how science teachers solve literal equations for the variable they want before substituting the known values. I usually substitute and solve.

There are many other differences that it is most helpful to experience in order to help students be successful in science and math.

PS Be flexible in your thinking and be willing to learn!

Dear math teachers,

First of all, this seems to be a great program. It is data-driven and experiment based. Physics uses much of the math that we teach and applies it to real-life situations. This real-life situation component could increase the understanding of our mathematics teaching.

Please check out the online resource on the Physics First website. This document for math teachers has a great resource for the type of math knowledge used in physics. Also, please see if you can get examples from the math perspective.

Many concepts taught in physics are the same, but many of the phrases and perspectives are different. For example, what math teachers call an x -axis and y -axis (using variables x and y), physics teachers use "independent" axis and "inde-

pendent variable" axis. The variable letters they use in the graph change depending on what they are graphing. Please be aware of how they are teaching this and make the distinction in your class.

You will need to get together with your fellow physics teachers and learn the basic components of the program. You will then need to develop a curriculum that incorporates problems and material that relate to both mathematics and science. Throughout the year you will need to work along-side your physics teacher and align your teaching to the topics being discussed in the physics department. Overall, communicate! Be very clear with your expectations, rules, policies as far as your students, parents, administrators and parents go.

Math teachers need to be flexible and open minded. They need to be able to work with their science teacher in a manner in which the students benefit the most. Each teacher needs to understand what the Physics First program is trying to achieve. Collaboration is of the utmost importance. Administrators need to be supportive of this program and try to figure a way that both teachers have time to collaborate and work together.

I really enjoyed attending the Physics First academy. All 9th grade math teachers of schools implementing Physics First should attend. It is an eye opener, and helps you appreciate your science colleague. The math part was very informative. You were given ideas to present your math material to support the Physics First curriculum.

Three points that I think math teachers should know going into

Physics First:

1. Physics First does not change what you teach or necessarily how you teach. What it does is broaden the conversation you have to have about concepts that will be used in both subjects. This conversation will be positive for all parties involved and should increase student achievement.

2. Communication between faculty members and administration is essential. There will be growing pains with this program, just like any other program. Open and honest lines of communication will smooth out rough spots and provide this program the chance it deserves.

3. The burden of implementing these new methods of science teaching is on the science teachers. I have witnessed some breathtaking levels of dedication and inquiry with the science fellows. Do what you can when you can to help alleviate this burden for your colleagues that sacrificed valuable time to better themselves and your school.

Fellow Math Teachers,

As you may know, we will begin the Physics First program in the 9th grade science classes. Physics involves a lot of mathematical concepts that the students will be learning in both their science and math classes. It will be imperative that the math and science teachers talk about which concepts that overlap will be and how we can teach/reinforce these concepts in a similar manner. I've learned that it really isn't that hard to come to agreements on this matter and will be very beneficial for our students. I also feel that there are several activities in the Physics First curriculum that would directly and positively reinforce/introduce certain

math concepts that our students would love. So it would be a great idea to possibly combine some algebra and physics classes. Overall, I think this program will really improve our students' math skills in the long run, as long as we're all willing to work together!

MEET OUR NEW SCHOOL DISTRICT CO-PI...

Becky Schauwecker replaces Sara Torres as Physics First's school-district co-PI, following Sara's move to Arizona.

Becky recently served as the secondary science curriculum and resource coordinator for the North Kansas City School District. She supported content specific professional learning communities. Areas of responsibility included analysis and distribution of MAP and EOC data, facilitation of the creation of district benchmark tests, curriculum development, implementation of professional development opportunities, the coordination of text adoptions, and the purchase of equipment and supplies for middle and high school science classrooms. Schauwecker was the district Physics First liaison for the DESE funded Physics First grant from 2005-2008. The district became a core partner with MU in 2009 to participate in the NSF funded Physics First grant. She has been appointed by central office administration to serve as the district liaison until 2014 and will teach 7th grade science for the upcoming school year.



FEEDBACK FROM THE ADMINISTRATOR ACADEMY

During the Physics First summer academy, each school administrator is invited to attend two days to learn about the program, network with other administrators, and show support of their teachers. This year, 14 administrators attended the academy in June. Throughout the two days, the administrators worked side by side with their teachers learning physics content and observing the modeling pedagogy in action. In addition, administrators were actively involved in leadership discussions regarding obstacles that leaders face regarding change. Both administrators and teachers expressed their appreciation for the two days they had to work together. Below are "letters of advice" to other administrators that could not attend the academy this year.

The Physics First Administrator Academy was a very informative experience. Every administrator should take the opportunity to observe and participate in this program to demonstrate support for their teachers. It would be very difficult to know how to support my teachers if I was not exposed to the curriculum, pedagogy, and philosophy on which the Physics First Program was founded. My teachers are more open to share with me their growth as well as their frustrations throughout this entire process. This is my fourth year of attendance to support my Physics First teachers. I have increased my understanding each year that I have participated! If you were unable to attend the 2010 Administrator's session, I recommend you make it a priority

for next year to be there to support your teachers! You do make a difference!!

Dr. Sandra Logan
Principal
West Junior High School

Take some time to sit down with your Physics teacher and your Algebra teacher and ask questions about the program. Ask them to teach a lesson to you so you will be able to see the difference in pedagogy associated with this program. The energy and enthusiasm will be quickly evident and it will be infectious if you let it. They are creating a different learning environment than most classes you have observed. Trust their training and their professionalism and let your science classes transform into something more meaningful.

Brian Sherrow
Secondary Principal
Marceline R-V School District

I would recommend to all administrators the importance of lending support to the teachers engaged in the Physics First program. While we lend our support to all of our teachers, I believe that administrators need to be especially aware of the level of support necessary to help guide the Physics First program.

This is a challenging, highly rigorous program that will engage our students on intellectual levels that they may not have reached thus far in their educational experiences. Essentially, this curriculum transforms the 9th grade science year from something mundane and traditional to something that is chal-

lenging, demanding and rewarding.

Physics First represents a significant pedagogical change in our high schools. I believe that 9th grade students and parents will need assistance with this process. To best help meet the needs of all invested school members, I recommend the following:

1. Providing lots of communication to the parents and students about the program. High schools must jump ahead of the curve and assume a greater proactive stance, in regards to communication, to help this program succeed. I anticipate many questions from our constituents, and I plan to succeed by getting information to them at every chance possible: through emails, registration days, back to school night, parent/teacher conferences, and any other opportunity that arises.
2. It was recommended to have some sort of Physics Open House for parents, where they are invited to the school and are allowed to engage in the scientific experiments in which their sons/daughters are engaged. We plan to implement this.
3. Know that there are bound to be some "growing pains." Students, teachers, and parents alike are going to experience frustration at some point. We administrators must be willing to listen and to get involved to help the transition.
4. Administrators must be highly involved with this program. We are very busy, but we have to allocate time to allow for deep involvement here. We must educate ourselves, especially in the pedagogy used.

5. Something has to be taken off the Physics First teacher(s) plate. This program will consume much of their time, and the school must be willing to help the teacher with this. One of the strongest ways we can do this is to relieve them of additional responsibilities that are not impacting student learning.

6. Give our teachers time to collaborate and observe other teachers in the program. They need to be in touch with colleagues teaching the same material.

7. Get to know your coach. Each school has one, and these people are valuable resources. They are well-trained in both the pedagogy and the content. The coaches are deeply committed to the success of the program and will offer valuable assistance to us.

8. Communication between the math teachers and science teachers is an absolute must. I learned that there are different approaches to the problem solving in which the science students will be engaged. Schools must have consistent terminology and procedures in order to best help their students succeed.

These eight items are essential commitments that principals must be willing to make. Lending our support and encouragement to our teachers is a vital part of the program's success. Our teachers must know that we are deeply committed to them and that we care about their success. Physics First offers great promise, in terms of student learning and student achievement. To help enable their success, principals must be aware of the commitments involved and must be willing to make those commitments.

Dale Van Deven
Principal
Southern Boone High School

REFLECTIONS: THE NEXT GENERATION SUMMER ACADEMY

Glenn Owens, Coach

It's Saturday afternoon and the end of a four-week, summer academy. I figured that this would be a good time to write some of my reflections about the past month while the thoughts are still fresh in my mind.

This was the best academy to date and those of us who had gone through the first generation have had several discussions to try to pinpoint the reasons why it went so well. When the first academy started in June 2006, there were too many variables and too many unknowns. This year, the support staff, under the direction of Sarah Hill, was always on top of things. There were no surprises and no down time. If a question came up, Sarah had an answer and a solution. Immediately.

As a coach/mentor, my job description during the first generation was not fully defined and many of the science teachers attending the academy were not sure how they were going to implement the new pedagogy, the new, ninth-grade

curriculum and fulfill all of the requirements for the college credits during the upcoming school year. This year, everybody knew what was expected and it seemed like the anxiety level for the fellows in the academy was much lower and the schedule and class discussions addressed issues that were specific to the needs of the fellows and the time-on-task for the entire academy was well planned.

What this says about the Physics First program is that it's a well-planned, evolutionary design. The fact that we have data that indicates higher math scores for students who have taken ninth grade PF adds more credibility to the program and helps to gain more support from other HS administrators and math teachers in the state. I have always enjoyed the summer academy and I feel most fortunate to have been selected for the second time. As a retired teacher, it gives me the opportunity to get back into the classroom as an observer/coach/mentor; it allows me to retire less abruptly. Life is good.



Doug Steinhoff, Peer Teacher, (standing) discusses a sticky point with Paul Schafer, Physics First Fellow, during the June 2010 Physics First Academy

BRAIN BENDERS

Dorina Kosztin, University of Missouri



THE FAKE COIN

You have 8 identical looking coins, but one is heavier than all the others. How can you identify the heavier coin? You may use only a pan balance and you are

allowed only two measurements.

[Note: this goes right along with a news report that one in 20 one-pound British coins is believed to be fake, telegraph.co.uk, 08 Apr 2009]

CHOO-CHOO, CRASH, BANG

Two trains are moving toward each other with speeds of 17 and 43 mph. How far apart are they 1 minute before they collide?

Hmm.. do we need more information here? Actually, not.



THE DIFFERENCE BETWEEN MASS, VOLUME AND WEIGHT

(from 190 Ready to use Activities that make science fun, by George Watson)

Read the paragraph, and find the word from the choice box below that should appear in each numbered box. Write the words against the corresponding numbered cell on the left. No word may be used more than once.

| | | | | |
|---------|---------------|-------------|----------|-----------|
| mass | weight | accumulated | material | size |
| blast | float | Earth's | escaped | different |
| expands | gravitational | constant | force | space |
| same | location | volume | changed | object |

| | |
|-----|---|
| 1: | HERE'S THE PARAGRAPH YOU NEED TO DECIPHER: |
| 2: | |
| 3: | |
| 4: | |
| 5: | THE TERM "MASS" REFERS TO THE AMOUNT OF SUBSTANCE OR __1__ IN AN __2__. |
| 6: | |
| 7: | |
| 8: | |
| 9: | THE TERM "VOLUME" REFERS TO THE ACTUAL __3__ OF THE OBJECT. THE SIZE CAN BE CHANGED BUT THE __4__ WILL REMAIN __5__. FOR EXAMPLE, WHEN WATER IN A CUP FREEZES, IT __6__, INCREASING THE VOLUME, BUT THE AMOUNT OF WATER OR MASS STAYS THE __7__. |
| 10: | |
| 11: | |
| 12: | |
| 13: | WEIGHT IS __8__ FROM MASS AND __9__ BECAUSE THE WEIGHT OF AN OBJECT IS THE AMOUNT OF __10__ PULL ON AN OBJECT. IT DIFFERS FROM MASS IN THAT __11__ WILL CHANGE FROM ONE __12__ TO THE NEXT BUT MASS WILL NOT CHANGE. LET'S LOOK AT AN ASTRONAUT. WHILE THE PERSON IS IN THE __13__ SUIT WALKING TO THE SPACE SHUTTLE ON EARTH BEFORE TAKEOFF, HE/SHE MAY HAVE AN __14__ WEIGHT OF 270 POUNDS. (THIS IS WHY ASTRONAUTS WALK SLOWLY TO THE SHUTTLE.) FIFTEEN MINUTES AFTER __15__ OFF, ASTRONAUTS WEIGHT ZERO POUNDS BECAUSE THEY ARE IN SPACE AND HAVE __16__ THE __17__ OF THE __18__ GRAVITY. THEY CAN __19__ AROUND IN WHAT ON EARTH WAS A 270 LB WEIGHT. THE MASS OF THE PERSON AND THE MASS OF THE SPACE SUIT HAVE NOT __20__, ONLY THEIR WEIGHT HAS CHANGED. |
| 14: | |
| 15: | |
| 16: | |
| 17: | |
| 18: | |
| 19: | |
| 20: | |

Solutions to April 2010 Brain Benders

CUTTING ICE



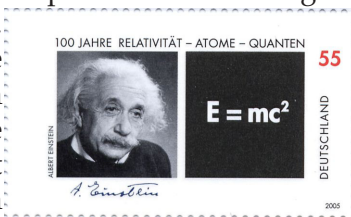
A single ice cube is floating in a glass of water. You hold a piece of string about four inches long. Problem: without touching the ice with your fingers, lift the cube out of the glass using the string.

Answer: Lay the string across the ice cube and sprinkle salt on top of it. The ice around the string will start to melt, and the string will be covered in water. But the cold ice cube will cause the salt water to freeze again. After a minute or two you can lift the string and the cube will adhere to it.

Advice: if you sprinkle salt on an icy sidewalk, make sure you use enough salt to melt all the ice, otherwise the water will freeze again.

VANISHING STAMP

Place a postage stamp face up on a table. Set a glass of water on the stamp. When looking from above or from the side, you can see the stamp. Cover the glass with a saucer that has a diameter bigger than the glass. Walk around the glass, peering into it from any angle you want: the stamp is now completely invisible! WHY??



Answer: Rays from the stamp are refracted up through the surface of the water. The refracted rays fall within a small cone around the straight-up ray. Beyond that cone, the rays are reflected back into the water. If you cover the top surface, you block off the cone of rays - so you cannot see the stamp any more.

COLORFUL CEILINGS

Place a pocket mirror in a bowl of water so it is at an angle of about 30 degrees to the surface of the water. Darken the room and shine a flashlight toward the mirror. What do you see, and why?



Answer: A spectrum of colors will appear on the ceiling. White light is composed of different wavelengths, corresponding to different colors. The triangular wedge of water between the surface and the mirror acts as a prism, refracting each wavelength at a slightly different angle. Refraction occurs because the speed of light in water is different than that in air. Furthermore, the speeds of different colors of light are different too, and that makes each color bend a different amount.

From "Entertaining science experiments with everyday objects" by Martin Gardner.

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
2011 summer academy: June 6-July 1, 2011
Follow-up meetings for Cohort 1: Oct 30, 2010 (Kansas City), Feb 12, 2011 and April 16, 2011
Pre-Academy Meeting for Cohort 2: April 16, 2011
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