A TIME for Physics First

Academy for Teachers
Inquiry and Modeling Experiences for Physics First
Leadership in Freshman Physics, 2009-14

NEWSLETTER: Vol 5, No 3, December 2012

Let's Review the NGSS!

Meera Chandrasekhar,
University of Missouri

The second public draft of the Next Generation Science Standards is due on 8 January 2013, and will be open for public comment through January 28. It is vital that the Physics First project have substantive input into this draft.

Twenty-six states led the process of developing NGSS, working with Achieve, Inc., a non-profit education reform organization. Missouri is not one of the 26, but we are among the 44 that support NGSS.

About 120,000 people contributed comments to the first draft in May 2012. In response to those comments, several changes occurred in the first draft. Several speakers at the NSTA meeting in Phoenix, AZ (Dec 6-8, 2012) stressed that teachers' responses to the draft, both in individual and in group format, was listened to in great seriousness, resulting in fundamental changes to get to this second draft of the NGSS.

As one of the few statewide Freshman Physics initiatives in the country, input from our Fellows and staff will be extremely valuable. At present there are 7000+ students in Missouri who take a 9th grade physics class. This group represents 35% of ALL students who take high-school physics in the state. Your feedback to NGSS will affect not only the national conversation but also the teaching of physics in the state.

Providing Input:

Here are two ways in which you can provide input:

- Work with a group of two or three other teachers and sign up to provide feedback to Achieve (www.nextgenscience.org.).
- Work with a larger group for a day (a Saturday in January, date to be announced when we know the exact date that the draft will be released) in Columbia. Yes, we will provide lunch and a stipend.

In both cases, we ask that you share with us the input you send in to Achieve, so we can collate your responses and include them as a group response (yes, they do give more weight to group responses!).

How do I organize a group and work efficiently?

We suggest reviewing the 9-12 grade standards for Physical Science and Earth and Space Science. These segments will cover all the content relevant to Freshman Physics. If time (and/or personpower) allows, looking at the progression of physical science topics from K-12 would also be of value.

An article in The Science Teacher by Ted Willard, Harold Pratt, and Cindy Workosky (October 2012) describes how to organize a study group and work efficiently. A copy of this article has been posted in the Resources folder in SAKAI (and is also available on the NSTA website). Below is a segment from their article (summarized):

First decide the scope of your study group, which will determine the optimal number of participants. You may choose to take a broad look at the entire NGSS second-draft document or focus on a smaller number of core ideas or specific grade levels.

...continued on page 2

Table of Contents

...continued from page 1

It is ideal to have at least two people working as a team to review standards within a core idea. They could be grouped by grade level.

If you can organize a larger group, you could create several teams to study multiple sections of the draft standards.

Regardless of the size of the team, the emphasis should be on depth rather than breadth. It is much more important to have an in-depth exploration of a few sections of the document, rather than a limited look at many of them.

If you are reviewing the NGSS as an individual, you may want to take only one strand or grade level/band to review. This may seem like a small segment of the total document, but it will allow you to become familiar with a portion of the standards and will result in a deeper and more valuable review for Achieve. A cursory review with limited depth of feedback, we think, is of little value.

One new aspect of NGSS is the inclusion of engineering as a core idea alongside life, Earth, and physical science. Even if you don't currently focus on engineering and technology in your classroom, you may want to explore these standards. In grades 6–12, sets of performance expectations are included that specifically address engineering and technology.

NSTA has developed a list of Suggested Study Group Questions to focus the group discussion. The first section (Figure 2, page 35 of the article) looks at one full set of performance expectations. The second section (Figure 3, page 36 of the article) explores a progression across all grades. **Each section takes 60–90 minutes to do on a single topic. A full-day meeting should allow time to be spent on all of the suggested questions on multiple topics**. If you only have part of a day, focus participants on just a few topics. Participants should have a copy of the questions and of the NGSS draft.

Other Resources

The following resources will help you navigate NGSS. The Framework document is worth reading before you get started (some docs already posted on SAKAI):

- *Framework for K–12 Science Education*, developed by The National Research Council (NRC), the staff arm of the National Academy of Sciences. The *Framework* was a critical first step because it is grounded in the most current research on science and science learning and identified the science all K–12 students should know. A free pdf download is available (http://www.nap.edu/catalog.php?record_id=13165). As of the writing of this article, we have requested permission to post this e-Book on SAKAI.
- A Reader's Guide to the Framework – developed by NSTA
- The Science Teacher article by Willard et al, referenced above.

From the NGSS website

http://www.nextgenscience.org

The release of the second and final public draft of the Next Generation Science Standards (NGSS) is set for 8 January 2013.

The NGSS will be completed in March of 2013. Since the May draft release, the Lead States and the writers evaluated the tens of thousands of comments collected during the May 2012 review period and worked on revising the standards. A feedback report will be issued together with the second public draft that will explain how feedback was handled and why.

The NGSS are composed of the three dimensions from the NRC Framework:

- Science and Engineering Practices
- Crosscutting Concepts
- Disciplinary Core Ideas

Here's a link for a recording of an MSPnet Academy webinar presented by Achieve: http://hub.mspnet.org/index.cfm/webinars/webinar_info?id=11

From Ya-Wen Chang, MU Graduate Research Assistant:

Meera Chandrasekhar, Joan Twillman, Lisa Grotewiel, Sara Torres and I delivered a presentation at NSTA regional conference in Phoenix, AZ. We shared the research and the success of the Physics First program with our audiences. Meera gave the audiences an overview of the Physics First project. I shared my research findings on mentoring and coaching. Joan and Lisa demonstrated the mentoring process in the Wimba platform. Sara addressed the importance of mentoring in teacher education to support teacher learning. It was a wonderful experience to share the Physics First project with others.

I took the Physics Praxis!

Kory Kaufman, Columbia Public Schools

Last summer I participated in the two-week intensive Advanced Physics class offered through A TIME for Physics First. Several of us who participated in the previous program joined the newest Physics First graduates to learn additional physics concepts not presented in the Physics First curriculum. The intent was to give us some additional physics knowledge but to also prepare us for the Physics Praxis. As one of the participants stated, "It's like drinking water out of a fire hose." The information came fast and furious, covering three to four chapters from the College Physics textbook each day.

I knew that if I didn't take the Praxis as soon as possible, I would forget most of it since I don't teach most of what we learned. Signing up for the Praxis was easy. I went to the website, found what test I needed, location closest to me, clicked a couple of things, entered a credit card and was done. Unfortunately the test was one month after the class ended - plenty of time for me to forget. About two weeks prior to the test, I went back through the book, workbook and my notes. I made lots of index cards about things that I didn't remember; emphasis on LOTS of cards. A big concern I had was that there were going to be problems involving calculations but calculators weren't allowed. I prepared as much as I could as a ninth-grade science teacher on summer vacation, which meant not that much.

When the test day finally came, it happened to be in MU Physics 123, which was good because it was a familiar place. When I finally got the test I looked at the first question and had no clue what the answer was. No problem, skip it and go to the next question. Damn, I didn't know that one either. "Don't panic, keep going." Fortunately I knew the third question. It went like this throughout the test; questions I had no clue, some I was partially sure and a few here and there I knew.

After going through it the first time, I went through again eliminating answers and making best guesses. I then went through it one last final time praying that something would help me with the questions I had no clue about. I made best guesses on most, random guesses on the rest and finished one minute early. I left feeling good that I had taken it but didn't feel real good about my chances. I really didn't think that much about it the rest of the summer. The school year had already started when I realized that I needed to go look for my scores; they weren't mailed to me. So one morning I logged on, found my score and saw that I had passed by 3 questions. Yippee! I was pleased I passed and am excited about the possibilities now available. It was an intensive process that was made less painless by the Physics First instructors and the support they provided. I would recommend it if there is a chance you might be teaching upper level physics courses. It was definitely like drinking out of a fire hose, but I liked it!

Working with my Math Teacher Colleague

Christy Dablemont, Hermitage R-4

I used to think that all math instruction had to be "seat work." In a recent collaboration with our high school math teacher I learned I was wrong. She shared a quick fun activity for making conversions that requires nothing more than a stack of note cards and a little advanced planning. I will share more ways that I have initiated collaboration between high school and middle school math and science in my small school.

The greatest challenge I have faced in collaborating with math teachers has been simply finding time to meet together. However, I have discovered that collaboration does not always need to take place in the setting of a formal meeting. Ideally I would love for the four teachers in question to sit down together in one room to brainstorm and troubleshoot but thus far we have not found the time for that to happen. I have discovered that it is much easier to collaborate when I place myself in the role of a "roving mediator" who connects with each teacher individually. When I drop in on one of the teachers to discuss strategies during a moment of free time, I initiate the conversation by offering to share something I have found that they may find useful. This effort is almost always reciprocated by the other teacher. I will then find time to get together with another one of the teachers in the network and share the information from the previous meeting where applicable. The end result has been a collaboration of sorts that, while not perfect, still works. It was during one such drop-in conversation with our high school math teacher that I learned a great activity to use in teaching conversions.

The only necessary materials are some pre-made conversions done via the factor-label method and some note cards – at least one card per student. On one card write the conversion you want to make, for example: Convert 2.5 cm to km. The second card will contain the first part of the factor-label table, example: 2.5 cm/1. The third card contains the next section of the table, example: 1m/100cm. The final card is the last step in the conversion, example: 1km/1000m. Be sure to include a card with the answer, example: 2.5×10^{-5}. Make a variety of different conversions, making sure that each student will get a card. Mix the cards up and distribute them to the students, then let them move around the room finding people who can build the complete table.

When I tried the activity with my classes I had good results. The students enjoyed getting up and hunting down the correct matches and I observed a lot of student cooperation as they worked together to come up with the right answer. This would be a good activity to use when conversions are first being taught, or to bring out later in the year when the skill might need to be reviewed. In the end I discovered that although collaboration with math teachers may take a little extra leg work, the effort turns out to be worth the benefits.

My New "Alternative" Position

Brie Roberts, Jefferson City Public Schools

This year, for the first time I am teaching at an alternative high school with at-risk students. I have worked with this population for many years in a regular or CWC classroom, but never in a closed setting like this and have quickly learned that it is a different world. This is the first year that freshman and sophomores have been at the alternative high school in our district. We have discovered that certain techniques that have worked in the past with the older students do not work with the younger students so we are adjusting plans that were in place for all students when the school year started as we try to address the particular needs of our students.

Here's an example: One of the techniques in place for juniors and seniors that has worked very well the past six years is making up missed hours during a fifth period. For each class a student misses they must make up an hour of time during the teachers' common planning period, fifth period. If a student has not made up their hours by each midterm then they are taken out of the alternative school program and sent back to the regular high school. This schedule allows the students to finish the school day early if they are all caught up and to make up missing work or hours during the regular school day. For the younger students the flaw we discovered is that those who ride a school bus must stay at school. If the bus riders are all caught up with their classwork we must find a job to keep them occupied during our planning periods or they will become a huge distraction to those that are actually working. We are adjusting by offering a Technical Reading class during fifth period starting in January for those students that stay because they are a bus rider.

When a student misbehaves and is disrespectful to a staff member it is an automatic two days OSS (out of school suspension). We have never had a fight at our alternative school and have a wonderful principal that attempts to put a stop to the regular teen drama as soon as we see it starting up. Students may be sent home for partial days if they are refusing to work or if they have their cell phones or other electronic devices out. We constantly remind the students that it is a privilege to be here at the alternative school and that there is a very long waiting list of other students that would love to fill their spot if they can't show us, the other students and the school the respect they all deserve.

Self Reflections - My Humble Opinion

Glenn Owens, Physics First Coach and Mentor

The purpose for having two cohorts in the Physics First project is so that we can compare the two different support methods – in-person coaching and online mentoring. Each Cohort 1 Fellow has a coach who visits the classroom and then discusses the lesson with the teacher. Cohort 2 Fellows have mentors who "visit" with the teacher on-line after the lesson has taken place. To do that, Cohort 2 Fellows fill out a Self-Reflection Form and send it (along with their lesson plan) to their mentor, then have a videoconference about that lesson.

The self-reflection process for many of the C2 teachers has been an eye-opening experience, not only for them but also for the mentors and the project leadership.

While reading the blogs by the C2 group I noticed one of the teachers had written a comment about how the Self-Reflection Form had improved her teaching and improved her self-confidence. In response, several other C2 teachers had made supportive comments and I felt that this would be an appropriate article for the newsletter.

On a personal note, when the concept of mentoring without observing classes was introduced to me, I was not enthusiastic about it. The idea of discussing a lesson that I had not observed seemed like a one-sided discussion where the

mentor would have no input into the conversation. Now, I realize that this concept is not about me and my ideas, it's about the teachers and their ideas. All of the teachers for whom I am a mentor usually select their most challenging class or the lesson that is the most difficult for them to present. They write a self-reflection about that lesson and we talk about it. Mostly, they talk and I listen.

This is my second year as a mentor in the program and I feel the need to give praises to the C2 teachers and some advice to others about using self-reflection. It is a great tool for all teachers to use. It does not matter what grade level you're teaching, your subject area or your years of experience, self-reflection is a worthwhile use of your time. As a mentor, I may sometimes ask a question or make a comment to assist the teacher, but for the most part, the teachers have already started the process for a new approach. This is the beauty of the Self-Reflection Form. A teacher can fill out the form and their thoughtful reflection allows them to "relive" that lesson; to see the lesson from the students' point of view, to gain insight for changes that may improve the next lesson.

Cathy, the C2 fellow who originally posted the blog that caught my attention admitted that she too was skeptical at first and thought it would be a waste of time. Quoting from her blog: "When I take the time to sit and actually type out the on-goings, I discover things that never would have been on my radar before because I never had the time to pause and see it. Many times, I realize the class wasn't as bad as I thought and determine the cause of my challenge. Even better, I develop solutions to help both me and my students."

Other C2 fellows responded with supporting comments. One teacher writes out a reflection each week. Sometimes it is for classes other than Physics First.

Laura, another one of the teachers for whom I am a mentor, is teaching in a totally different environment this year. She has moved to an alternative school and she has students every day for 90 minutes classes. This is the first year she has taught the Wave Unit and that's the lesson that she chose to use for her reflection. For those of you who do not know Laura, let me tell you, she is not afraid to try new things nor is she shy about asking questions. She questions everything.

Because this is the first time she had taught the lesson on Waves, this was truly new territory for her and our discussion was quite different from other reflections we have had. She is always excited to talk about what had been done in the class and how she might make changes next time, but this one was more animated and sometimes she would change topics mid-sentence. I was so busy following Laura's directions to "go to the web site," "look at this data sheet," "see how they calculated speed," et cetera, that I did not get to do much writing….and all the while, Laura was saying, "I just don't know what I'm doing with this unit. It is so new to me. I spent three hours on this one lesson and I already know that I'm going to make changes next year."

Later, as I reflected on our conference, I realized that she was thinking out loud. At the time, she did ask me a few questions, but in retrospect, those questions may have been rhetorical—or maybe she was just being polite and wanted to make me feel as if I were part of the discussion.

Here's a suggestion for all teachers - the next time you have a class period that just was not up to your expectations, write out a self-reflection. Include what went well and what did not go so well. (You need to do it that same day—while it is still fresh in your mind.) Generally, you will realize that there may be some changes that are worth trying. Sometimes you may come to realize that it was nothing you had done so much as it was a chain of events that may have included a fire drill, a school event (homecoming), the weather, or any combination of other things that can lower the slope of the learning curve in a classroom. I think that having another person to discuss your reflection is a plus, but the act of reflection itself is a quality use of your time.

The result of this particular conference was enlightenment for me. It made me take time to reflect. I listened as Laura talked about going back to the Physics First materials and reading/studying the Wave Unit; how she processed that information; evaluated it; arranged it; and then presented it to her students; her special students.

As I now reflect on my teaching career and the reflection conferences with all of the teachers in my group, I realize that all of our students are special. They are ***our*** students and we must do more than understand the material. We must make it our own if we expect the students to accept it from us.

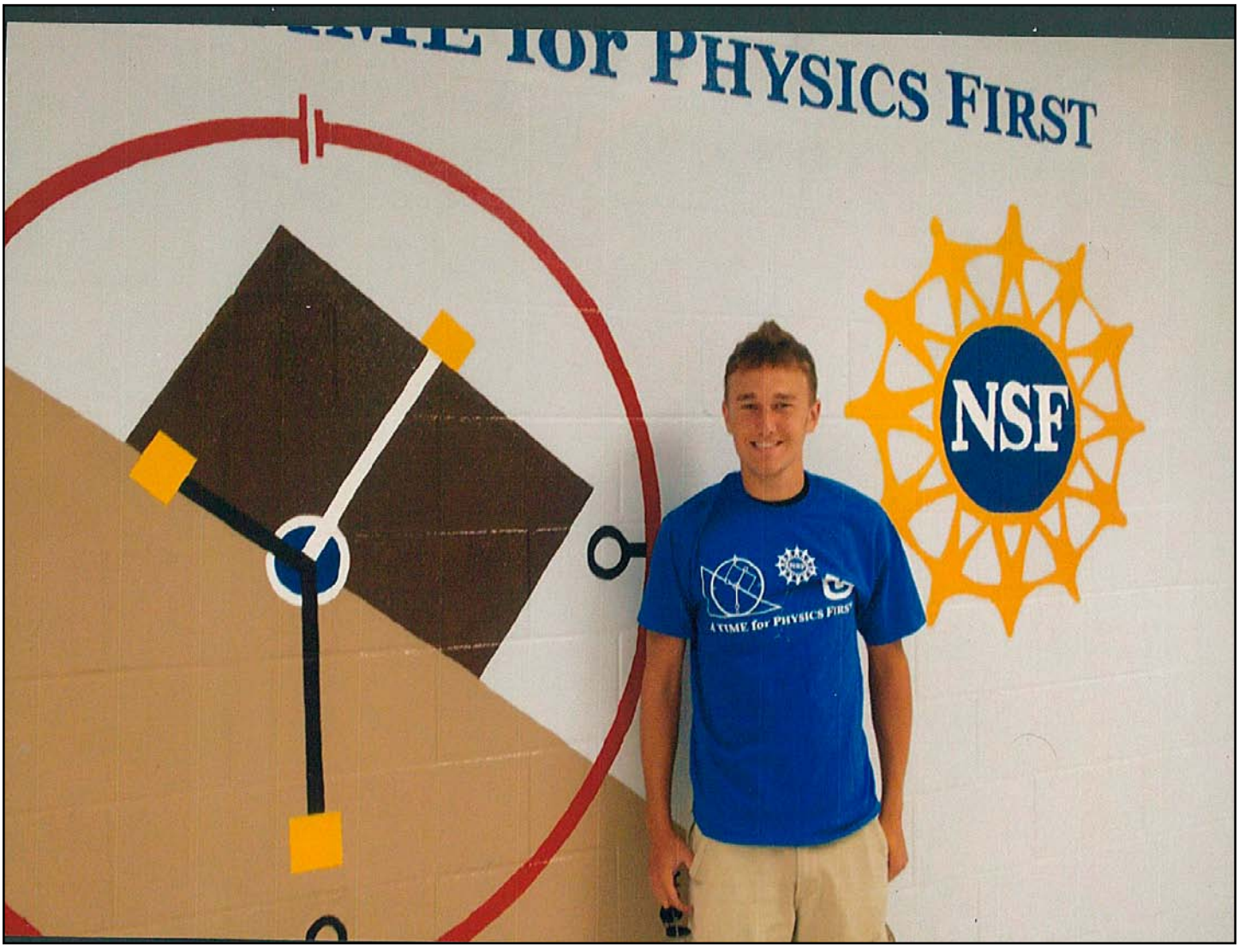
Our Freshmen Promoted Physics First

Jerry MacLean, Lone Jack High School

Lone Jack freshmen educate our community about what "Physics First" is all about. Two years ago, our students began transforming a large blank corridor wall located outside the Physics First (PF) classroom and across from the high school library. The transformation, completed for the current academic year, showcases the *A TIME for Physics First* project logo.

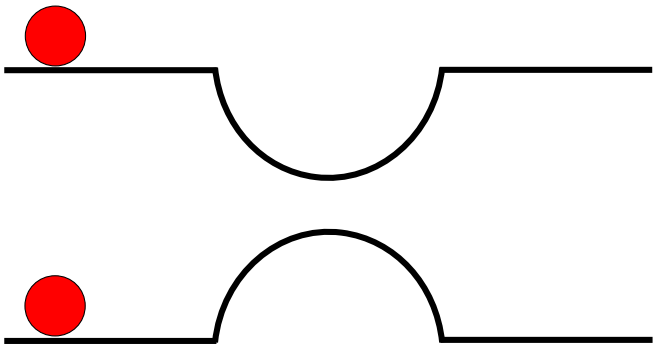
All patrons of the Lone Jack community pass through this hall and by this giant mural every time they enter our school. After two years of student construction, I am happy to report that the mural is complete. People begin to understand that our freshman physics curriculum is supported by district participation in the PF project hosted by MU and funded by the National Science Foundation. The PF program has become a major portion of our curriculum and a foundation for Biology, Chemistry and Advanced Physics in Lone Jack.

The PF classes have generated a special relationship with the math department. Math teachers prepare lessons to enhance the PF student's algebra and graphing skills used in hands-on lab experiences. Our students show their pride in the program while sporting their new PF t-shirts. Taking the PF logo and printing t-shirts for all our students was their way of "getting the word out" for this year's project.



Solution to August 2012 Brain Benders

1. Marble race: As shown in the figure below, two identical marbles start with the same speed and roll along the two horizontal tracks. One track has a dip and the other one has a bump of the same shape. Which marble will win the race to the other end of the track? The marbles never lose contact with the surfaces and there is no loss of energy due to friction.

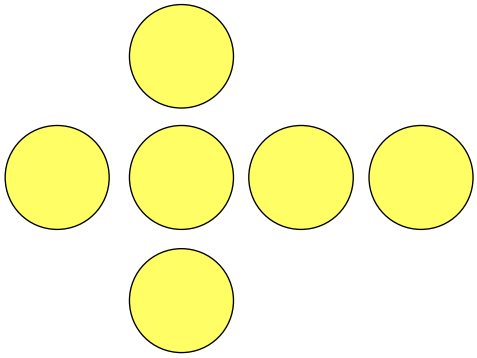


Answer: the top ball will win the race: it speeds up in the dip while the other ball slows down over the bump.

2. Trapped on ice: A person is standing in the middle of a frictionless icy surface of a lake. How can he move to get to the shore? How can anyone land up in such a place in the first place?

Answer: He can throw something and as a result of Newton's 3rd law he will move in the opposite direction. How he may have gotten there is a good question. Maybe a crane placed him there... ☺

3. Coins in row and column: Below, move only one coin so that there are 4 coins along each line.



Answer: Move the one farthest right on top of the one in the middle.

BRAIN BENDERS

The Cold Drink

At a bar, there is a bucket containing ice, some of which has melted. A bartender gets an ice cube weighing 20 grams from the ice bucket and puts it into an insulated cup containing 100 grams of water at 20 degrees Celsius. Will the ice cube melt completely? What will be the final temperature of the water in the cup?

The Mathematics Class

All students in the physics class also study mathematics. Half of those who study literature also study mathematics. Half of the students in the mathematics class study physics. Thirty students study literature and twenty study physics. Nobody who studies literature studies physics. How many students in the mathematics class study neither physics nor literature?

The Aquarius Problem

You have to measure exactly 4 liters of water, but you only have a 3-liter bottle and a 5-liter bottle. How do you do it?

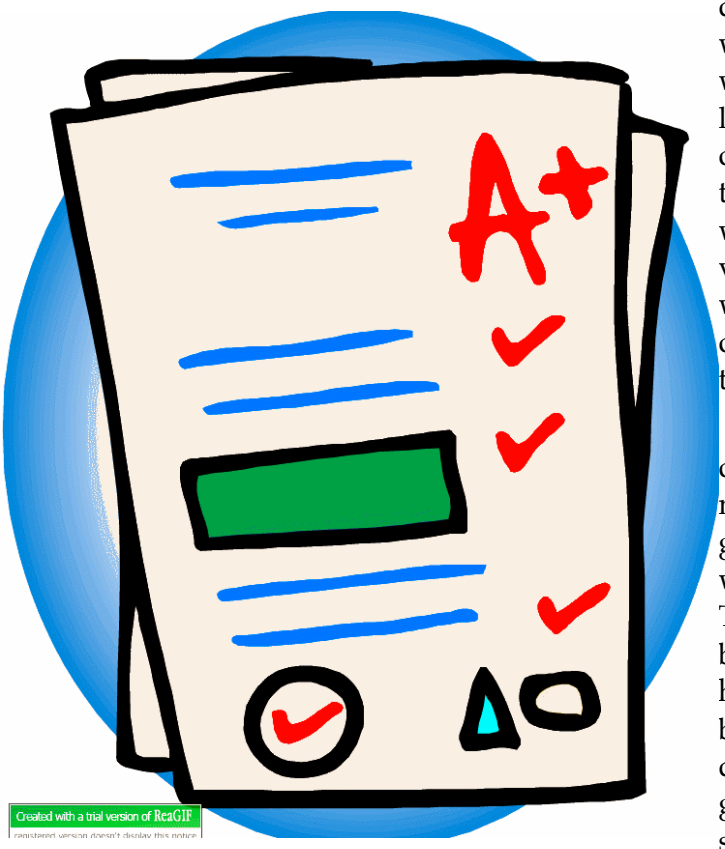
How We Created Assessments

Gloria Gammel, Springfield Public Schools

As we have implemented the Physics First program at Parkview High School one of the biggest things we felt was missing from the curriculum was assessment questions, including a variety of Depth of Knowledge questions for students with a wealth of diversity in background knowledge as well as understanding of the content.

At Parkview we teach Physics First to three levels. We teach "Regular Physics First." These are the typical students. Many take a math class concurrently - Algebra, Integrated Math and a few in Geometry Honors. We have an upper level or "Honors Physics First" comprised of students who choose to be in an advanced class, these students are typically in Algebra or Geometry Honors. This class includes more of the math and advanced content. Finally, we offer a lower level class within a class or CWC. This class includes regular students but also all of our students with special needs. This course has a second special education teacher who has been involved in all of the training and works exclusively with one teacher on the planning and structure of the class.

The variety of student learning levels and teaching needs required us to search for ways to assess our students at their levels. We came up with two methods. We have formative and summative evaluations for each unit. Last year we implemented formative assessments for the first time. These are quizzes between six and eight questions long that are given through Achievement Series, administered to the students at the start and end of each unit. We use the data gathered from these quizzes to compare our courses. We look at the data from the pre- to the post-quiz as well as what is happening in each teacher's classroom. We have expectations for the Honors classes as well as the CWC classes. We also give common summative assessments and use this data to gauge how we are doing as a school in preparing our students for future science classes as well as standardized exams such as the EOC.



The biggest struggle for us in creating these two forms of assessment was generating the actual exam. This was a collaborative effort that was initiated by John Thompson (a non-cohort Physics First teacher from Parkview) and me and grew to involve our entire Physics First collaborative group. We all began to see the benefit of having one general source of questions for our assessments so there was a huge benefit in collaborating as we did. Since we teach students at a variety of levels we could ensure that there were questions for each level in the test bank. We could also make sure that the questions were well written and had a range of variety and difficulty that would have been more challenging for a single author.

At the start of the process I realized just how much my colleagues struggled with the software we were using for the tests. This is not to criticize them but to say that I should have kept my mouth shut because now I have been dubbed the "computer guru." It has been my pleasure to do the computer work related to the generation of our test banks. While the questions themselves are very much a collaborative effort, the construction in ExamView was completed by yours truly. I say this only for the following reasons: the test banks have been loaded onto Sakai and are updated each time we update

ours (which is usually as we sit down to work on a test at the end of a unit) and I include instructions in this article for uploading the test banks to your computer.

Please feel free to bring your computer to any of our future meetings and I will help you with the upload. I cannot provide the ExamView software as it is only available when you purchase another textbook as our district has done, but I can teach you how to access these test banks once you have the program. I apologize in advance for any problems you may note in the test banks. The tests have been reviewed by several individuals but mistakes can slip by us. Once you have ExamView installed you can add your own questions or make corrections or changes to the questions already in the bank.

If you have trouble locating a bank on Sakai or have trouble uploading the bank to your computer feel free to email me at ggammel@spsmail.org .

Instructions for Uploading ExamView Test Banks:

(I am using the Accelerated Motion Test Bank for an example)

Install ExamView

If you don't already have this program it comes with many textbooks and you or a colleague may have gotten it. I would ask around your building.

Pay special attention to where it is going to store the files it puts on your computer. If you already have ExamView you might do a search for the files. Knowing their location is helpful.

Locate the Test Bank you wish to download on Sakai. (Follow the path below)

Resources

Stuff to Share

Unit 3: Accelerated Motion

"Tests and Quizzes"

Accelerated Motion.bnk

Select the bank

Select "Open"

The bank will open in ExamView

To Save to your hard drive

File

Save As

My Computer

C:

This is called "Local Disk" on my computer but yours may be different. It should be your computer's hard drive

ExamView

Banks

Here I created a new file entitled "Physics First" and put all of my test banks in there.

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

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Support: This project is supported by the National Science Foundation grant # NSF DUE 0928924. NSF is not responsible for the opinions expressed in this publication.

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