

# DOINGWHATWORKS



Video

FULL DETAILS AND TRANSCRIPT

## Strategies for Engaging Students

Hillcrest High School, Texas • November 2007

Topic: Encouraging Girls in Math and Science

Practice: Sparking Curiosity

### Highlights

- At least 2-3 times a week, physics students at Hillcrest High School get opportunities to get out of their seats.
- Physics projects may include: egg drop, constructing a catapult, a Rube Goldberg machine and musical instruments. Students may also do projects on additional topics that are not part of the curriculum, such as nuclear physics and misconceptions in science.
- Young men often have more physical intuition than young women in high school physics. Their intuition may be derived from experiences at home such as fixing a bike or riding skateboards. The lab lessons help provide the experience that young women were lacking so far.
- The physics teacher, Daniel Brown, connects concepts such as center of gravity of object to areas of interest of girls, such as cheerleading stunts.
- Students work in gender-segregated groups to avoid the influence of stereotypical gender roles on students experience in physics labs.
- It is very helpful to encourage students to teach their peers. Students doing tutoring during class time are internalizing the material on a deeper level. Students being tutored get immediate assistance when the teacher is busy helping other work groups.

## About the Site

### Hillcrest High School

Dallas, TX

#### Demographics

53% Hispanic, 29% Black

59% Low-SES

33% Limited English Proficient

52% Females

Hillcrest High School, an urban school that serves a primarily ethnic minority population, has been recognized for its efforts to promote students' enrollment in Advanced Placement (AP) courses. For example, this school ranked in the top 5% of high schools in the country, according to Time Magazine, for AP exams proctored. They encourage girls by:

- Active recruitment of girls to AP classes
- AP physics teacher trained by the Center for Gender Equity
- Technology grants pursued to enrich school labs
- Encouragement of hands-on scientific inquiry in the classroom

## Full Transcript

Students often sit in a classroom and have a teacher stand in front. And whenever they can get out of their chairs and do something, it's always an advantage. So at least a few times a week, if we're not doing a lab, we want to do some kind of activity that gets them out of their chairs. "Everyone come over here and watch this demonstration. Everyone, we need to go outside for this demonstration."

Whenever you can find something that gets everyone physically up out of their seat, whether it's a lab situation or something else, you're going to actively engage them at a different level. We typically will do some sort of egg drop with a wide variety of requirements. Some sort of catapult. Something with simple machines and levers. This year we're doing Rube Goldberg machines. Musical instruments. Design circuits.

During units that are not as project-based, say nuclear physics, they'll often write a paper on misconceptions in science. And so I will give them a list of 100 different misconceptions and like a sweater actually keeps me warm. A lot of people think well the sweater actually like, will actually keep you warm by providing warmth itself, rather than by insulating and reflecting the warmth back to you. So they'll study misconceptions and they'll say, "I didn't know that was a misconception." And then they'll have to write a paper after choosing half a dozen or so.

There's no doubt that when we do a lab activity or we're building on projects, that a lot of the young men in the room have a lot more physical intuition. That is, they've done some of these things before. Maybe dad asked them, "Hey help me change the oil." Maybe dad said, "Well, your bike is broken, why don't you

go ahead and fix it. I'll show you how." And perhaps they weren't as quick to do those things with their daughters in some households.

So I know and I hear from many of the students that, "Well, I don't know how to do that. I've never done that before." And I hear that much more often from the young women in the room than from the young men. And so, it's definitely an opportunity for them to start exploring. And specifically for the girls, it can really help to level the playing field because it's so un-leveled sometimes when they walk in. Very often, when I ask a question that's conceptual based, a young man will raise his hand and say, "Well I did this on my skateboard the other day. So I know the answer is this." And I don't get that as often from the young women.

But by including a lot of labs and a lot of hands-on activities, it helps to level that playing field of physical intuition. So that now we're really talking about: Do you have the critical, analytical thinking skills? Do you have the mathematical maturity with your algebra to get your hands on and solve the rest of the problems and understand what's going on in the situation?

There have been times that I've had groups where there are two or three cheerleaders in one lab group at that moment, and they'll ask a question and not really understand something about center of mass. Well, we can talk about when they toss a cheerleader in the air and that cheerleader does two flips and comes down and is caught. But the cheerleaders all know that when they're spotting, they need to be watching the center of mass of that cheerleader—that the entire body weight is rotating about that point. And that's something they've done many, many times; so you can take the almost abstract concept of a center of mass or the center of gravity of an object and how it moves in a straight line when you toss it up in the air or down, or it moves in a parabola even as the whole object rotates around it—and you could really begin to have a lot of concrete meaning in their mind and their life by connecting it to something they do on a regular basis, which are cheerleading stunts.

And so by connecting it to something they know in their world, you make it very relevant to them, and all of a sudden they think they're really good at physics because they're like, "Oh, I do this all the time." And so they can not only understand, but hopefully get excited about it.

When I first started taking some in-service classes on gender equity, one of the things I decided to try was to segregate the classroom so that lab groups were either all male or all female. When students choose projects outside a class, they're allowed to mix and choose their partners. The lab specifically, there's one student who's kind of assigned to the computer, one student who's assigned to the cars, another student's assigned to data and those roles will rotate over time. And there's also plenty of interaction between the students even though one student may have an assigned role.

And so you assign those roles to give different students experience with different things. But if the group's all girls, the girls are going to have to do it. And if the group's all boys, they're going to have to take notes, even though they usually have the girls take notes. And so it really helps to break down some of those

walls and also provides a very safe haven where the girls aren't feeling threatened or they have to take the lab equipment away from the boys. That doesn't happen. They can gain a lot of confidence in hands-on activities on their own with each other, and they won't stay segregated the whole year. Towards the end of the school year, we'll begin to integrate them. In the second year calculus based course, I don't assign the lab groups. They're allowed to pick and they do pick, sometimes single sex, sometimes mixed. And they're allowed to. But the roles are still assigned and rotate. But since they've already been with me the first year, they know what my expectations are, they're aware of the gender bias considerations, and though they will often slip back into the traditional roles—you know, then instead of trying to force a format on them, instead what I'll do is I'll tell the students as I did this spring once when I noticed, "I just wanted to make an announcement that I noticed in every lab group there's a girl taking notes." And immediately some of the young men were apologizing, they were going, "I'm sorry, Mr. Brown. I just didn't bring a pen today." Or some other silly excuses.

And I said, "I wasn't condemning anyone or saying it was wrong. I just wanted to say that I noticed." And they often do, without reminders, slip back into traditional roles. And one of my functions is just to be here to remind them so that they're aware and that they can then be outgoing, they can be proactive and they can get involved as much as they want to.

It's extremely useful to have students peer teaching each other within groups. I can't be everywhere at once, especially in a class of 30 or more. It's just not practical. And so by having the students' desks arranged in a group setting all year long, and the groups will rotate about every six to nine weeks, I assign those groups. There's usually a student who's really strong in math in each group because I control that, and there are students who are very strong mechanically and conceptually in each group, and they kind of move from one to the other throughout the year.

This allows the students to have various strengths in each group, which may be harder to work together, but when they do work together they can accomplish more than they ever could alone. And whenever a student has to tutor or help another student, then they have to internalize it enough to then synthesize it and explain it to someone else. And as every teacher knows, it's one thing to know something; it's another to teach it.

And so the students who are doing that tutoring during class time when I'm helping another group are actually really internalizing it at a deeper level and helping themselves while helping someone else in their group who they're tutoring.

And so I'll usually work with each group until one or two students really understands what's going on and I'll say, "Thanks. Please help your other group mates." And then I'll move on to the next. And that's a very powerful tool for keeping more students actively engaged all the time during class.