Advice for the Young at Phyz

Notes from the NCNAAPT New Teacher Workshop

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We all develop ideas on how best to do our jobs as physics teachers. These are mine, based on my experiences with my students at my school. I don't presume they're the best ideas or that they'll work for you as well as they work for me. I present them here for you to peruse and consider. Use what you can. For more ideas, see my website at www.phyz.org.

1. Content Coverage: How much material should I teach?

A course in high school physics can include a huge number of topics. But remember: you've got at most 180 days with your charges. So how do you want to spend it. If you try to cover everything, you'll be in a race to the finish and you'll always be behind. Some might elect to teach only mechanics. (Advocates of the increasingly popular "Modeling Physics" program appear to favor this approach.) I would propose a different approach. I suggest teaching the content covered in the California Academic Content Standards for 9-12 Physics. Motion, force, momentum, energy, heat, electricity, magnetism, waves, light, and wave optics. In fact, I would limit myself to only the "required" topics. Fewer topics; more time on each topic. But don't spend the whole year on mechanics! Don't leave out rainbows and the blue sky! If you follow this approach, you'll be good to go with the Golden State Exam in Physics and the STAR Augmented Physics test. And you can impress your administrators when you tell them that you're covering the standards.

If you can possibly manage it, get a second-year physics course going, such as AP Physics B. This lets you teach all the things you left out of the first year course.

2. Funding Sources: Where do I get money to buy toys? (I mean "apparatus.")

First, put together a wish list. Gather some good catalogs. (I like PASCO, Sargent Welch, Science Kit, and Arbor Scientific; your tastes may vary.) Set up a spreadsheet and get the items entered in excruciating detail: catalog numbers, item names, per-item price, etc. Include vendor addresses, etc. Organize it into modules: a motion module, a heat module, etc. Keep each module at a reasonable dollar figure. The point is this: funding opportunities sometimes come up on short notice (OK, they always come up on short notice.) He who is ready with a detailed list is likely to get that list funded! Here are a few sources I do my best to avail my program of.

a. GATE: Gifted and Talented Education. This is a pot of money determined by the number of GATE students at your school. Find out when the funds are distributed and what the process is for getting some allocated to your program. Get yourself on the committee that decides the allocation! Often, these funds go wanting. Be ready with your wish list.

b. PTSA/PTO: The Parent organization has an interest in supporting the instructional program at your school and often expends a great deal of time, talent and energy to raise money. When it comes time for them to fund programs, be first in line with a modest list for them to fund.

c. SIP/Title This/Chapter That. Chances are, your school can tap into some special state funding source on an annual basis. Often, a site committee of parents, teachers, students, and administrators decides the allocations. They'll be impressed by your detailed list.

d. District / Adoption: Sometimes, textbook adoptions come with funding for instructional materials. Occasionally, districts get one-time funds for lab upgrades. There was a recent allocation designed to get labs in shape to teach the State Academic Standards. Whatever the occasion, tap into it!

e. Boosters Group: Get a group of parents to draft a letter that begs families for a little money to help with science materials. Send the letter home with students. Give them extra credit for returning a portion of the letter with a parent signature. Tell them to keep the part of the letter that has a place for the family name, donation level, and address to send the donation. Very effective: most folks want to help, this makes it easy for them to do so.

Again, I can't stress this point too strongly: get funded early and often!

3. Paperwork Management: How do I reduce my grading load?

a. Homework. Provide abbreviated answers (not solutions, though). Never "grade" the stuff. Give minimal credit (if any). See "the system." Remember, homework is practice, not assessment. Sometimes, students will plead a case for getting points for homework. Here's an idea to help them understand why they don't get such credit. Ask if any of them play sports. Ask them how many points their team is given on game day for practicing throughout the week. None? Then why practice? Hmmm....

b. Labs. Grade only one lab write-up per group. Give each student in the group a number (I use groups of four). At the end of the lab, pick a number between one and four. The student in each group with that number turns in their write-up. Everyone in the group gets the grade earned by the selected write-up. This way, all students in each group have an interest in making sure that all their partners do well on the lab.

4. Spotlight Avoidance: How can I minimize lecture?

a. Springboards: I use "interactive" Springboards to introduce and/or develop concepts. They're handouts with questions and partially completed diagrams that we complete as a classroom project. I guide the discussion and keep it on track, but I feign great ignorance and implore the students to give each answer/response in the sequence. I ask them to check with their neighbors at various points as well. If you go to my website, you can find Springboards on the following topics (and then some).

- Numerical Notation (Prelims)
- Newton's Second Law (Newton's laws)
- UCM (P:CC) (Uniform Circular Motion)
- Intro to Momentum (Momentum)
- Intro to Work (Energy)
- Newton's Law of Cooling (Heat)
- Current and Voltage (Electricity)
- Intro to Waves (Waves)
- Refraction Index (Light)
- Interference in 2-D (Wave Optics)

b. Demonstrations. Too often, we have a great demonstration to do, but we hustle through it without getting the full value out of it. Slow down! Explore the subtleties! make sure you set it up thoroughly so the students fully appreciate the wonder of the demo. I prepared demonstration sheets for each of the following and more. (Check the website.)

- Blowout (1-D Motion)
- Great Bullet Race (2-D Motion)
- Cannonball (P:CC) (Inertia)
- Nailed! (P:CC) (Energy)
- Ball & Ring (Temperature)
- Radiometer (Heat)
- Van de Graaff (Electricity)
- Moving Sources (Waves)
- Laser Tank Refraction (Light)
- Vertical Bulbs (Wave Optics)

They lead students to predict, argue, vote, and discuss.

Odds & Ends

Video Resources

a. Mechanical Universe: I use the high school adaption. Seven VHS tapes, four ~15min episodes each. Also available in the full-fledged college edition.

b. Physics: Cinema Classics - Laserdisc, originally developed by AAPT, features film snippets from PSSC films, Encyclopedia Britannica films, Ealing, Newton's Apple, etc.

c. Kinetic Karnival: Jearl Walker's videos (GPN-distributors).

Concrete Management Ideas

a. Storage: Milk Cartons - cut them to form strong storage boxes.

b. Label lab items by group letter (A-H); fewer items go missing when there is group-level accountability.

c. Test Security: Two forms for those sitting side by side

d. Notesheet: stamp blank sheet the day before the test. OK to write anything BY HAND. Can use on the day of the test, not on day of make-up (fewer cases of test-itis)

e. Keep extra credit to a minimum. Instead, offer "CTF" (credit toward the final): points that can be used to replace points missed on the final exam. Unused points go to the great point-patch in the sky. No one ever ends the semester with more than 100%.

f. Test Correction Journal: Post-test review... by students, NOT by you. Give them a copy of the test and have them talk their way through their mistakes with those who got those items right.

g. Keep a record of what you did on which day. (And maybe notes as to how well that schedule worked.) Refer to it next year and make adjustments.

h. Advertise to build the program: "TAKE PHYSICS understand the universe," for example.

i. Across-the-curriculum: Give item from *Physics Begins with an M* or *Thinking Physics* to student. student translates item into Spanish, French, Korean, Chinese, Hebrew, Swahili (preferably something you can check via a colleague). Their translation is to be formatted as a poster (with nice graphics, etc.) that you can hang in your room or--better yet--you can get the language teachers to hang in their rooms. *Spread the Word!*