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A brief primer - What does a high school physics teaching job entail? Where do you start? You enter a classroom that you have been assigned to. You immediately realize that the job is an "inheritance", i.e., what has been left to you to work with. You inherit the condition of the room, the textbooks, paper and/or electronic, possibly lab manuals, apparatus, etc. You inherit a budget that must compete with the other sciences in the department. Most of the above depends on the professionalism of your predecessor, i.e., how things were left; everyone's teaching style and emphasis (favorite topics) is different. Also, you must contend with state and local curriculum requirements and levels of expectations by the local board. The job is difficult, one well beyond what most people imagine. We have all had to start somewhere and have gone through the process. Mistakes are inevitable, but how you recover and learn from them is the key to your growth and success.

In the 1960's, I chose a teaching style that was in vogue, the lecture-demonstration method, one used by a cadre of people who practiced it at a very high level and were very successful with it. I followed their example. This paper is about suggestions you might follow if you wish to succeed using this style. Let's start with the curriculum and ways to mobilize your resources. This style relies heavily on apparatus, better known in my school as "Johnston's toys".

A general survey course in high school physics bears the burden of five major subject areas that require apparatus unique to each area, i.e., not reusable in other areas. And most of this apparatus is not cheap, especially if used in a laboratory setting where many stations must be equipped. Generally, the major subject areas are mechanics, heat (thermodynamics), waves including sound (acoustics) and light (optics), electricity and magnetism, atomic-nuclear; all require unique, expensive apparatus if taught well.

To build a strong program will require the commitment of the administration, money made available, and teacher longevity. It will require a constant juggling act involving content priorities and available funds. The money, usually limited, and how you use it, is crucial. At the beginning, some extra money may be provided to help get you started. Later, you are on your own to garner funds as best you can. So immediately take inventory of your resources and establish a list of priorities that you can justify. Competition is keen; the other sciences, because of higher enrollments, always have an edge.

The sciences have the hands-on laboratory component that can be very expensive; much depends on how you approach it. I learned early on that two students working together at a station was best but not always possible due to a shortage of high cost apparatus. However, over a period of several years and adding piecemeal, I could fully equip each station; it required patience and determination. Also, I continually looked for "weak" spots in my instruction in each area and how I could strengthen them with the right piece of apparatus; I tried to add a major piece (purchase) each year. Thus, if you remain at the same school for a long enough time, you will accumulate the tools needed to demonstrate many topics well, resulting in a stronger program.

During your initial inventory, you will learn of your predecessor's strengths (favorite topics) and weaknesses (little attention). Achieving a good balance among the major subject areas is a necessity for a quality, general survey course. Attempt to correct the weakest areas first; it may take several years but must be done.

The lecture-demonstration style is both educational and entertaining (show business), but always educate first! If it entertains, that's a bonus. However, it is a style that relies heavily on apparatus and thus, funding. But many pieces aren't manufactured or can't be bought. What do you do? You can choose to set up a home workshop and make them yourself. You didn't bargin for this? Hundreds (thousands?) have been doing it this way for a hundred years or more, and it can be fun. Designing and building apparatus can be a life-long hobby, one you can even deduct from your income taxes as an educational expense! Have the school pay for the difficult pieces, and you build the easy ones; all keeps adding to the total you need to teach with. Yes, it requires extra time and money on your part, but all hobbies are like that.

How do you build a shop and learn the necessary skills? Most hobbies begin this way, but that's the fun of it, you learn as you go along. Find someone with the same interest, a friend or relative, who can guide you; many are willing to do something for education. Lucky me, I had a skilled uncle who did fine woodworking as a hobby; he taught me most of what I know and still use. He recommended "flatwork", the use of pine, plywood, and masonite (tempered), not turning (lathe work), for beginners. Most of the website projects are flatwork. Two major shop tools are needed, a table saw and a drill press; they provide accuracy (precision) and give your projects an appealing, professional appearance. Remember, anything that looks good is half sold! Two other handy, large tools are a scroll (jig) saw for cutting curves and a 1" belt sander for smoothing shapes of all kinds.

Of course, much can be accomplished with hand power tools like circular saws, jig or sabre saws, and drills. Two cordless drills, one with a drill bit and one with a Phillips bit are very handy when assembling projects; #6 coarse thread drywall, Phillips head screws are strongly recommended. Of course, the common hand tools like rulers, squares, screwdrivers, pliers, wrenches, chisels, hammers, clamps, shears, and compasses are required; however, rarer tools like carton knives, awls and vernier calipers are extremely useful. You will add tools as you need them or as they come on the market; tool invention is endless.

Sometimes, however, you need something made of steel or brass, maybe threaded, on a lathe. I contacted a skilled machinist at a commercial machine shop or at a college; I found they were willing to help a physics teacher.

Keep in mind that this paper is about ideas and suggestions; the alternatives are limitless. You will decide what is best for you. I can only say that they worked for me.Where did the ideas for these website projects come from? Most are from practicing colleagues across the country, namely at physics teacher meetings and NSF institutes (PSSC and HPP). I grabbed onto any good idea I could find, then found ways to make it better, and passed it on. I know that others took my ideas and made them even better; that's progress! When I retired in 1992, 70% of the apparatus I used in my teaching was learned at these meetings.

In conclusion, many of the website projects are many decades old, but a really good idea can stand the test of time and remain a useful piece of apparatus to make a physics lesson better, make a concept more understandable. The aim is always to improve instruction.

A personal note. I benefited greatly from my membership and participation in two professional associations, AAPT and STANYS (Sci. Teach. Assoc. of NY State); they actually serve two different groups of physics teachers. By sharing, however, I learned much from each group. I was lucky; in my third year of teaching, I landed a full-time physics job in a good high school where I could grow and build a quality program using the process I've outlined in this paper. I was able to remain in this job for 29 years, the longevity that I needed to reach my goal. Only one unrealistic wish remains. If only I had had the program the first several years that I had in my last years, how much more my first students would have benefited. However, the bright side is the "inheritance"that I was able to leave my successor.

Addendum: The above workshop or woodshop can also handle acrylic sheets and soft, "hardware store" aluminum with fine-tooth saw blades; special blades are made for these materials. Also, taking the place of hand planes, is the jointer, a useful, but nonessential, power tool that might be added to the basic four mentioned above. It removes saw-tooth marks and neatly trims the edges of pine boards.

Before the year 2000, electronics projects "exploded" due to Radio Shack, Heathkit, etc. The need for a soldering table or bench with the necessary tools and good lighting was essential. Even today, there should be a special, small space in your shop for this important activity, if only for repairs. The most important tools to start with are soldering irons of different sizes, a minivise, an adjustable, "close-up" lamp, alligator terminals as clips (clamps), long-nose pliers, a wire cutter, a wire stripper (razor blade), steel wool, screwdrivers, a short ruler, and a sponge (wet,as a "wiper").