Remodeling Physics Rooms

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First and foremost: Make sure pedagogy drives placement of everything in your room. It is not enough to have new equipment in your room if placement of the equipment makes it useless. Envision how you will use everything; how it will function together. I recommend that you use a draw program and make a scale model of your space including tables, chairs, demo desks etc. Move everything around to see what works best. Be sure to consider the transitions from sitting and listening to active labs, to demonstrations. How should the traffic flow, for the learning to be the easiest? (See the two diagrams at the end of this article.)

Jargon & Who's on First? Learn the power structure (of the architecture firm) relative to your project, learn the building code, and don't take a "no" as absolute. Argue with the FAX (to people who make the decisions); put it in writing. Be hard-headed and hard-hatted (make FREQUENT on-site inspections). Do what is best ... show it off ... then beg forgiveness if necessary.

Student seating: Individual student desks vs tables for two: If you decide on tables, make sure they are 30 inches wide so that a computer and keyboard will be able to fit if needed. A 24" table is too narrow for a computer and keyboard. An arrangement of 6 two-student tables on either side of a teaching computer in the middle of the room has been an excellent arrangement for me. I am more or less in the middle of my students and they need only pivot their head one way to see the computer screen projected or the other way to see the whiteboard space (3 large whiteboards). Looking straight, they see me at the computer. Each group of 12 students sit facing each other. (See both diagrams. Steve has lab groups of 4 students who use 2 computers. In modeling instruction, groups of 3 who use 1 computer work best. For modeling instruction, one would design the room such that the projection screen is on the opposite wall, in place of one whiteboard. That would free up the space where the projection screen originally was for two more lab stations.)

Floor, ceiling, ventilation: Choose a tile floor rather than carpet. An open ceiling allows for creative lab setups. Avoid air vents above people or computers. Light colors give spacious feeling.

Lighting: Make sure the overhead lighting turns on in zones appropriate for different activities. For example, you should have the option of turning off all lights in the demonstration area for experiments. Most fluorescents have a small 10 watt bulb add-on that you can specify so that, with all main lights off, there is enough low-level light to see to take notes and see calculators, but not enough to interfere with a projected computer image. The lights should be remotely controlled by the teacher at the instructional center of the room according to zones.

Zone 1:	all on
Zone 2:	every other fixture only above student seating
Zone 3:	only 10 watt "night light" fluorescent on
Zone 4:	all off

Lights should not be on between the projector and the screen for a computer screen projector; those lights should be dimmable. Lights should be controllable from each exit door.

Electricity: When you make a scale drawing of a physics room, determine where you want the computers to be, then position electricity for experiments away from the computers. Any circuits for experiments should be separate from circuits for the computers so that devices like heaters, etc. will not be able to bring the computers down. Make sure these separate circuits have four outlet

boxes, not duplex (2 outlet boxes). Consider ceiling-mounted outlets above student tables as a way to provide electricity to the center of the room without resorting to floor sockets. This arrangement is used often in industrial technology classes. A good way to keep the wiring accessible is to have a raceway. A raceway is an enclosed box on the exterior of the wall which houses the electrical wiring. It can also house the telecommunications wiring. The exterior nature of the raceway means that trouble-shooting or adding circuits is very easy, compared to flush wall wiring. Make sure that the raceway is mounted ABOVE the height of any table placed against the wall so that you will not have to move a table every time you want to plug in and out.

Computers: All computers should be networked. If the computers must be on a countertop, check the cabinet clearance to make sure that computers can slide under the cabinets. Try to position the computers so that the instructor can stand in one place and have a clear view of any computer simply by rotating his or her body. This is as important for security as it is for pedagogy. The room should have white boards and use dustless markers, because chalk dust and computers are a very bad combination. Reserve 50% of the purchase price of the computer for software and memory.

Network: Have a minimum of 4 more ethernet drops than the number of computers at lab workstations: 1 drop for a printer, 2 drops for the instructional (teacher's) computer so that a guest has a dedicated drop, and 1 drop in the storage room. If the room will be used for a workshop, 30 drops should be installed. Demonstration desks should each have at least one ethernet drop. Mark all drops at the drop and at the hub with ID numbers. Network cables should be routed from the first floor through plumbing holes in the floor to avoid cables on the floor or overhead poles. For first floor rooms, it is especially important to have conduit laid before pouring concrete so that the cabling can be routed to demo desks invisibly.

Projection: Make sure that projecting a computer image has a clear flat projection surface. A dedicated high quality wall mounted screen, even sheetrock, is preferable to a typical hanging screen in order to keep the image as flat and focused as possible. Budget for a good computer screen projector; expect to pay about $3,000 to $4,000. Ask for a dealer demo in the room intended for use. If an overhead LCD panel is used, find a brighter-than-normal projector. Consider window coverings or blinds if necessary.

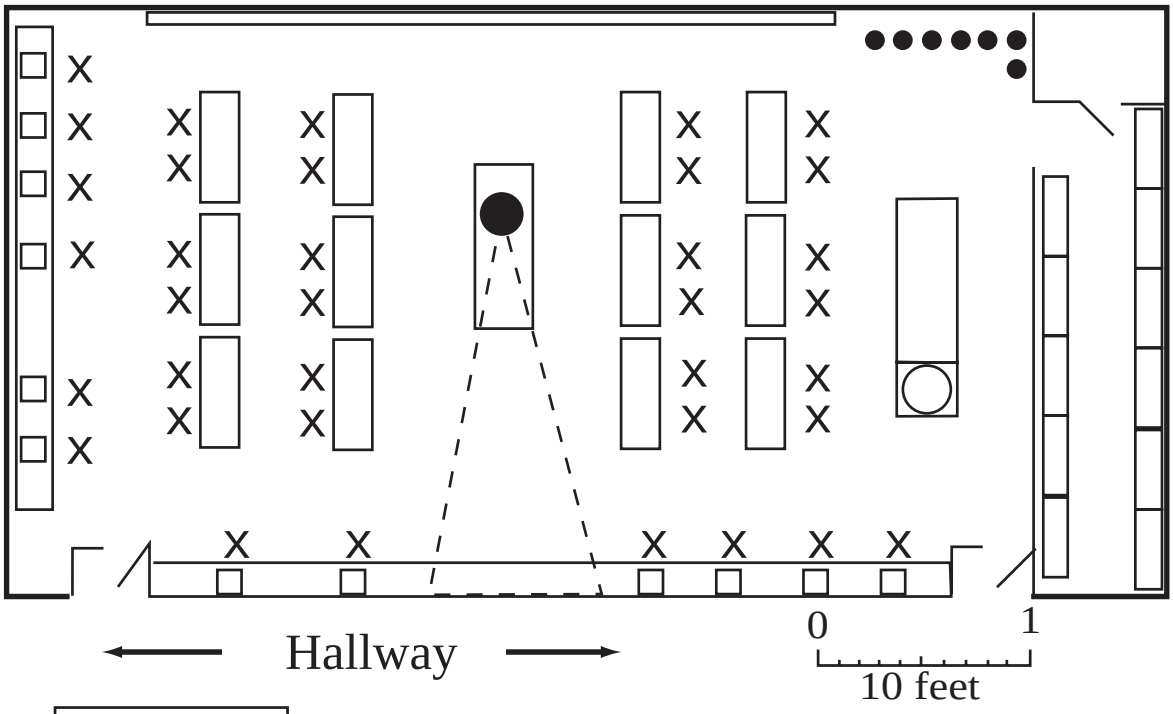
Printing: Have 1 decent networked laser printer, and locate it near an exit, since student printing often happens near the end of class and "on the way out". This also makes it easier for instructors and students in other classes to print and pick up copies, if they are on the network. Have message LED's visible to all. Budget for a dedicated printer stand with paper storage and recycling.

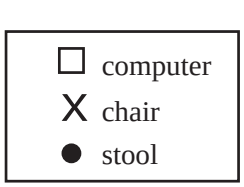
Storeroom: It's important to have a separate, secure room to store equipment. Include a desk or countertop for repair and/or for a computer. **Plumbing:** Consider a sink location very carefully; don't put it on a demo desk!

Security system: Aside from the obvious reason, it may curb public use of the physics room for meetings, debate tournaments, etc.

Support: Full time computer & network support person, or at least someone on-site, for all of the building's needs. **Replacement Plan**: Budget right away for replacement of instructional technology as it ages. Advocate for technology as a means to better education, not an end.

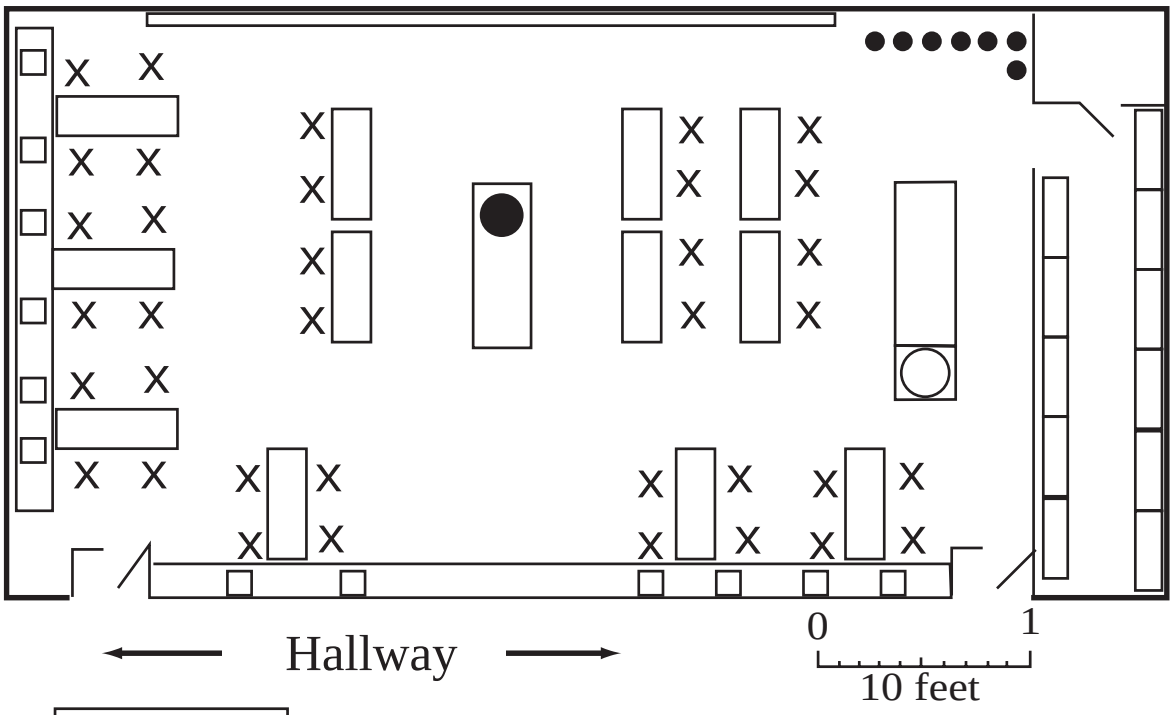
Cost: Earl Feltyberger renovated his 30' x 30' physics classroom with this design for $60K + $20K for 9 computers (8 workstations, 1 whiteboard, no new wiring). He is pleased. Nicolet High School, Glendale, Wisconsin, Earl_Feltyberger@nicolet.k12.wi.us.

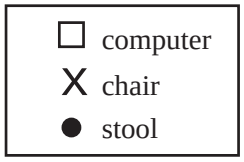




Set for Listening

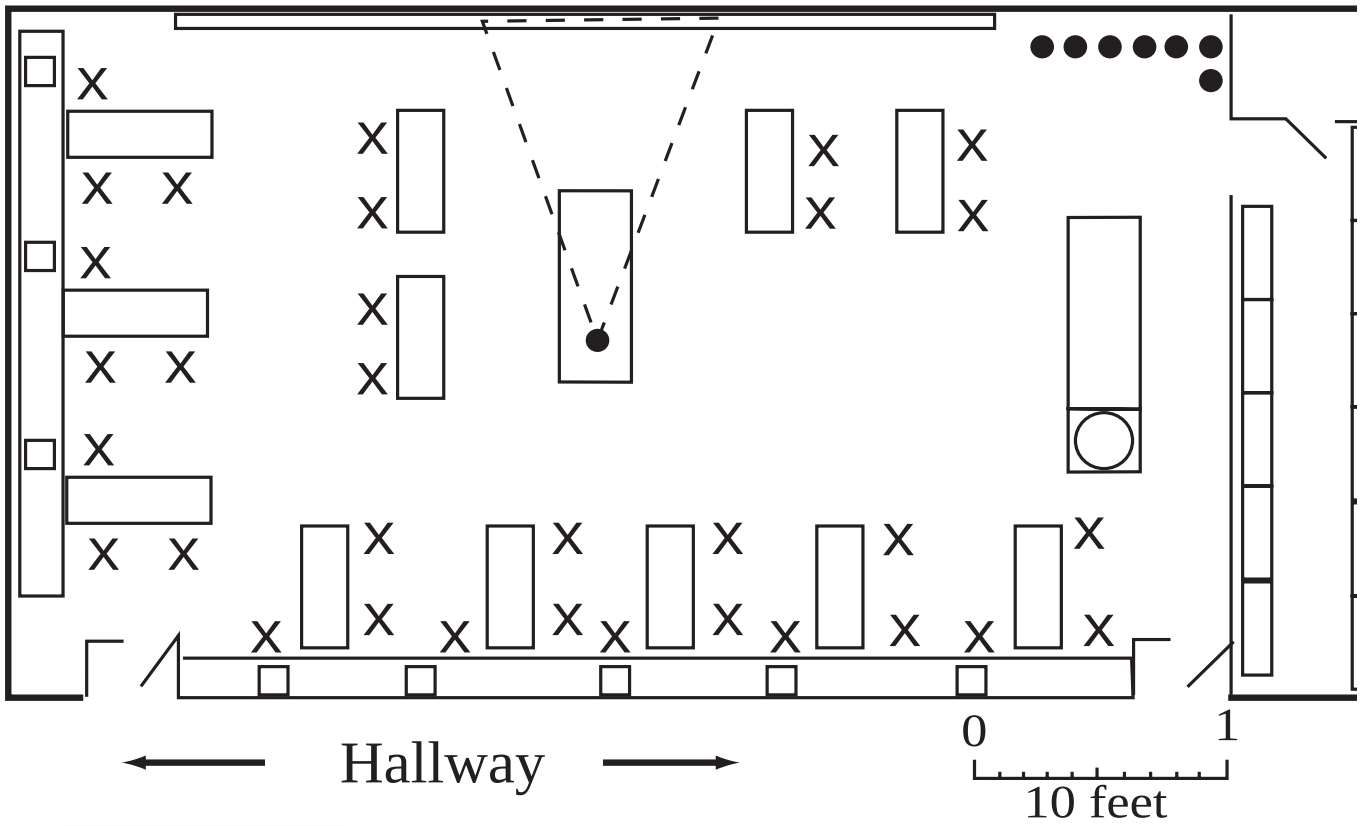
(Steve Skinner's design)





Set for Lab

(Steve Skinner's design)



Set for Lab

(Modeling Instruction design)