DESIGN CONSIDERATIONS FOR CREATING AN EDUCATIONAL PHOTO DARKROOM
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As a professor of photography, perhaps you dream of teaching in a great darkroom you have personally designed, a place where your students can produce high-quality negatives and prints with ease and within a class period.

Just imagine that the chairperson of your department informs you that your school is going to build a new fine arts building. You must submit your requirements for the photography department at a planning meeting with the architect in thirty days. This is a heavy assignment and you will need to find help. As you plan, keep in mind your design must be compliant with the "Americans with Disabilities Act" guidelines as well as all federal, state and local codes.

Start early to plan! In this scenario you have only 30 days! A good slogan for you to remember is "A Good Design is a Joy Forever." Conversely, a poor design will cause continual aggravation. Let's get started.

1. DEFINE YOUR REQUIREMENTS

Begin by asking your chairperson how much floor space is available for the photography department and how much budget is projected to build the photo department. Also ask for funds you will need to engage a "design specialist" to help you with your design.

Immediately contact your colleagues with outstanding facilities and successful programs and ask for their recommendations. With reference to your curriculum and class size (see page 2), list what your students should learn and do, period by period. Then use this list to prepare a second list, itemizing the features you will need in your new facility.

2. SEEK PROFESSIONAL HELP

Engage a "professional darkroom design specialist" as soon as possible (check references & budget a few thousand dollars). Your designer will need your list of requirements, equipment catalog sheets, your sketches, a copy of this article and the information you have adopted from your colleagues. When you meet your designer, review your entire list of requirements in detail and draw up a schedule of meetings timed to reach your goal. You must be decisive; there is no time to repeatedly change your mind.

Conceptual floor plans with dimensions, elevation views, casework and equipment list keyed to the floor plan, a cost study and architectural, plumbing, electrical and ventilating specifications are the documents your designer should prepare for your proposal. This work can be accomplished within two weeks if you are decisive and have a good designer.
3. CONSIDER THE FUNDAMENTALS

Only casework (cabinetry) and equipment (sinks, etc.) fastened to the building are included in the facilities design and budget proposal. Enlargers and other "plug-in" equipment will be listed in another budget. As you read this overview of the necessary facilities refer to the Floor Plan illustrated on page 3.

A Finishing Room usually includes a light-tight Film Room used for winding bulk film on cassettes and winding exposed film on developing reels. The Finishing Room contains a film processing sink (doubles as a print toning sink). A vent-hood is required at the sink to exhaust hazardous fumes. A film drying cabinet adjacent to the sink will expedite drying and protect negatives. Slide-out print drying screens in base cabinets are necessary to enhance drying. Provide lots of counter tops (with storage below) and work tables where students can finish their prints. The walls above the counter tops make excellent print display areas (students like to show their work).

The Darkroom is a large safelighted room with enlarger stations at the walls on each side of a central walk-around print processing sink with print washer and squeegee board. The sink must be equipped with a fume exhaust vent-hood. The sink should be long enough to accommodate half to three-quarters of the class at one time. An automatic silver recovery system should be located below and connected to the sink dump-trough. Remember to provide adequate storage space.

4. PLAN WORK-SPACE BASED ON CLASS SIZE

First, determine the maximum number of students in your class. It is best not to exceed 16 students per teacher, especially for an introductory course. All 16 of these students will occupy both the Darkroom and the Finishing Room during the same class period (not 16 students in each room).

For a class of this size, the Darkroom will require at least 35 square feet per student. The Finishing Room (including Film Loading Rooms and Light-Trap) will require about 46 square feet per student. These requirements are based upon clear, open space without columns, stairwells or angled walls. A 60" diameter wheelchair turning circle must be available in every room. All hinged doors must be 36" wide with 24" of clear wall space on the latch side. Student work space should not be less than 24" left to right, and 36" for handicapped students. Floor space between enlarger stations and the processing sink should be 7 or more feet so the teacher can easily circulate among the students. The drawing on page 3 illustrates adequate spacing.
(WORK SPACE, continued)

Calculate room sizes. Finishing Room: 16 students x 46 square feet per student = 736 square feet. Darkroom: 16 students x 35 square feet per student = 560 square feet.

Although hypothetical, the illustration below is a practical study of juxtaposition and the features of these rooms.

Legend
1. Display walls - finished in light-gray cork tack board - countertop to ceiling
2. Base Cabinets with multiple slide-out Print Drying Screens
3. ADA Counter top 30" deep x 34" high with storage cabinets below
4. ADA Counter top 36" deep x 34" high with storage cabinets below
5. ADA Counter top 30" deep x 42" wide with wheelchair opening
6. ADA work tables 96"x36"x34" high with locking casters (4 students per side) (castered ergo-pneumatic stools by others)
7. ADA PVC Film Developing & Print Toning Sink with 5 Temp Controlled Wash Stations & Dual-head Eye-Wash
8. PVC fume exhaust Vent-Hood with adjustable damper plates & PVC stack
9. Stainless steel, filtered hot air, Film Drying Cabinet for 35mm x 36 exp. film
10. Return-air Duct and Pipe Chase
11. Closet for Supplies with lock
12. Light-tight Door Seals
13. Light-tight Entrance-Exit Maze with walls, floor & ceiling finished in flat-black
14. ADA Film Loading Room with 34" high Counter Tops 17" & 25" wide
15. Wall Storage Cabinets with ADA Base Storage Cabinets & Counter Top at 34" high
16. ADA Enlarger Station for a wheelchair student with removable shelf and "drop-easel" feature for other students
17. 15 Standard Enlarger Stations, 36" wide, with Light Baffles between each station, equipped with drawers and shelves
18. Overhead Safelight (4) reflects safelight from a white ceiling, 9-6" high ceiling
19. Large Squeegee Board over Print Washer
20. ADA Circular Print Washer with Temperature Controlled Wash Water
21. Automatic Silver Recovery System reduces silver in effluent to less than 1 part per million
22. PVC Fume Exhaust Vent-Hood exhausts chemical fumes evenly full length of sink
23. ADA PVC Print Processing Sink provides ample space for 10 students at a time. Sink is 12'-9" long (plus washer) x 51" wide, equipped with Mixing Faucet & Dual-head Eye-wash
24. Return-air Duct and Pipe Chase
5. CHOOSE THE BEST LIGHT TRAP

To prevent white light from entering the print processing Darkroom, while providing easy passage to and from the Finishing Room, you will need a good Light Trap.

Figure 1 shows a rotary door (plan view). The outer cylinder is stationary and has two openings. The inner cylinder rotates manually and has one opening. The rotary door provides for traffic in one direction at a time and holds only three or four students. Rotary doors are mounted against a wall with safety hardware so that a 60-pound push on the Darkroom side will allow the entire door to "pop-out" in case of an emergency. A rotary door requires minimum floor space as compared to other types of Light-Traps. Remember to reserve floor space in the Finishing Room so the door can be pushed out without blocking traffic.

Figure 2 shows a two-door dark hall (plan view). Both doors must be fitted with light-tight seals to stop light leaks. The trap must provide a 60" wheelchair turning circle beyond door swing arches. This trap will work if only one door is open at a time, a difficult, if not impossible, policy to maintain with students.

Figure 3 illustrates the Maze, the best Light-Trap if you can afford the floor space. The Maze permits traffic in both directions at the same time without the use of doors. In order to completely defeat the reflection of white light entering the Darkroom, the Maze must be built and finished according to Figure 4 on page 5. The Maze requires about 132 square feet of floor space, whereas the rotary door requires only half that space. Rotary doors are often selected by architects to save floor space. Teachers, on the other hand, prefer the Maze for obvious reasons.

A very poor choice to control light is the use of "black-out" curtains at doorways. Curtains do not enhance traffic patterns in and out of the Darkroom. They are also difficult to keep clean and keep in position. To carry a tray through curtains is a difficult task.
The Maze must be constructed and finished exactly as specified below in order to keep white-light from entering the Darkroom. The dimensions shown in Figure 4 must be followed very carefully. The Maze is considered a room; therefore, space for a 60-inch diameter wheelchair turning circle is required.

The ceiling, floor and walls must be finished with a non-reflective "flat-black" finish. The Maze is the only room in your design to be finished in "flat-black."

6. CONSIDER ROOM FINISHES

A smooth gypsum board ceiling is superior to a tile ceiling, especially in the Darkroom. Most ceiling tiles flake-off and drop dust, lint and other particles on negatives, prints and equipment. In some cases, tile ceilings leak white light from adjacent rooms. Epoxy painted concrete block walls are an excellent choice of wall finish. They are easy to clean and they are very durable.

Ceilings should be white for maximum reflectance from safelights. A white ceiling in the Finishing Room will greatly enhance the general room lighting.

Darkroom walls should be painted a very light gray. To minimize reflections at enlarger stations, the walls are sometimes painted "flat-black" to a height of 7 feet above the floor. This is very helpful when working with color materials. Finishing Room walls should be covered with a continuous cork "tack board" material from counter top to ceiling painted a very light gray color to enhance displays.

Floors in the Darkroom and Finishing Rooms should be finished with an "non-slip" tile of a "slate-gray" color such as Armstrong's Step Master Excelon Tile #50792. This tile has a rough surface to prevent slipping on wet floors and is easy to clean.

Light Traps must be finished "flat-black" on all surfaces (ceiling, walls and floor) and maintained a "flat-black" to prevent white light from reflecting into the Darkroom. It is necessary to paint the jambs and thresholds of hinged doors leading to the Darkroom and Film Loading Room with a "flat-black" finish to stop light leaks.

CAUTION: Do not paint Darkrooms black. It is impossible for safelight to reflect from a black ceiling. A black Darkroom is a depressing place to work!
7. PLAN ADEQUATE VENTILATION

The following is general information. A qualified professional engineer must be engaged (usually by the architect) to design your ventilation system in accordance with specific site conditions and code regulations (since each project is different).

According to code requirements, general room air must be circulated at the rate of 15 cubic feet per minute (cfm) per student for Classroom and Studio areas.

The International Mechanical Code (2003) requires air exchanged at 0.50 cfm per square foot of floor space for Darkrooms; for example, a Darkroom 24'-0" x 24'-0" is 576 square feet; therefore the Darkroom requires 288 cfm general ventilation. Often the vent-hoods at sinks are used as part of the general room ventilation system.

Since it is recommended that a slightly negative air pressure be maintained in the Darkroom so that odors do not escape into other areas, it is also recommended that air filtration be included in the system. In theory, the more filtration the better; however, filtration raises the operational costs and limits the type of equipment that can be used.

Placement of the air-supply, return-air grills and vent-hoods (at each sink and processor) is extremely important. Figure 5 illustrates an incorrect placement of both air-supply and return-air grills. Adding to this error, a vent-hood is missing at the sink where chemical fumes are generated. This configuration draws chemical fumes across faces of students causing a health hazard.

Figure 6 shows a correct, safe and healthy system. Air is supplied and returned correctly and a vent-hood positioned just above the sink draws fumes away from faces. In Figure 6, the key is the correct placement of the air-supply and return-air grills, protecting the student with a correctly designed vent-hood precisely mounted above the sink with equal fume capture-velocity throughout the entire length of the sink. This is essential to maintain a safe and healthy Darkroom environment.
VENTILATION, continued

Figure 7 shows correct Darkroom ventilation for print processing using a walk-around sink. Fresh air is supplied and diffused at the ceiling while return-air is taken away near the floor providing good circulation throughout the Darkroom. A well-designed and well-positioned vent-hood is mounted above the sink to exhaust chemical fumes away from students' faces (on both sides of the sink). A sink with slot-vents in both sink rails, the entire length of the sink, is the ultimate method of removing chemical fumes at tray level.

Room air temperature should range between 72° and 74°F (70°F is recommended for winter months.) Room air should be filtered, replenished with fresh air and well circulated. Relative humidity should range from 55 to 65% when the room air is at 74°F.

8. CONSIDER THE WATER SUPPLY

Again, since every project is different in many ways, it is difficult to specify exact pipe sizes and pressures for sinks and print washers. All this is best assigned to a professional engineer qualified to design your system. It is good to supply the designer with manufacturer's catalog sheets for faucets and temperature controls you want to use.

You must be assured that (all faucets open at the same time) you will have sufficient water flow and pressure to wash negatives and prints. Emphasize this with the architect.

Water should be filtered and must be clean and clear. A 20 micron water filter panel at each sink and each washer is a very wise investment. Hardness of water should be limited to 40 to 150 ppm (parts per million) of CaCO2. The "ph" (parts hydrogen, a measure of acidity) should be between 7.0 and 8.5. Hot water temperature should range between 110° and 120°F. Cold water should be supplied at 58°F or lower; if this temperature cannot be maintained, an under-the-sink water chiller unit should be installed. Cold water lines require insulation to eliminate condensation. Hot water lines should be insulated to conserve energy.
9. SPECIFY CORRECT WASTE (Drain) LINES & TRAPS

Waste lines carry sink effluent to a sewer system. A trap should be located in the waste (drain) line below the sink to prevent sewer gas from entering the Darkroom. Since some photo chemicals are acidic, the waste lines and trap must be made of a material unaffected by acid. Polyvinyl chloride (PVC) pipe and fittings, ASTM D2665, are an excellent choice.

10. PLAN TO RECOVER YOUR SILVER

In most silver halide processes, less-exposed and unexposed image areas drop silver into the fixer solution. The silver that collects in the fixer must be removed before the depleted fixer ("spent-fix") is poured down the drain. To effectively remove the silver from the "spent-fix" is not only required by federal, state and city codes, but it is the right thing to do. CPAC makes an automatic unit that fits under a sink. It will remove all but "less than 1 part per million." When correctly installed and monitored there is usually enough silver to pay for refining and purchasing replacement cartridges.

Figure 8 shows a CPAC silver recovery unit installed under a typical wall sink. In diagram, the right corner has been cut away to show a dump-trough into which a tray of "spent-fix" is poured. A holding tank pumps "spent-fix" thru silver collecting cartridges. A Tee (1-1/2 x 1-1/2 x 3/4") is installed above the PVC trap to conduct the silver-free solution to the sewer.

11. CHOOSE PVC

PVC plastic will not corrode and is not affected by photo darkroom chemicals. PVC equipment can be made to fit any design. PVC is not molded and can be fabricated to any size and feature required. PVC is strong, durable and, with reasonable care, could last a lifetime. PVC is a thermal insulator and will not "sweat" with condensation in a humid room. A dielectric, PVC will not conduct electrical current nor cause electrical shock. PVC does not transmit tray clatter during agitation of chemicals, is easy to maintain, and has a porosity almost as fine as glass. PVC has a low reflectance and a very clean appearance. PVC is an excellent material for your Darkroom.
12. DESIGN for SAFETY

Consider personnel and environmental safety. The Occupational Safety and Health Administration (OSHA) requires all personnel be trained in lab safety and be protected from hazardous fumes and chemicals. A binder containing Material Safety Data Sheets (MSDS) (available from your supplier) for each chemical must be on display at all times. Care must be taken to prevent corrosion build-up and chemical spills. All chemical containers must be conspicuously labeled. A dual-head emergency eye-wash unit is required in each processing room as well as a spill-kit, fire extinguisher and first-aid kit. To remove silver from chemicals is required by federal, state and local codes ... it's the right thing to do.

Chemical fumes must be captured and exhausted through a correctly designed and tested vent-hood precisely positioned where the fumes are generated. Film and print sinks and processors must be thoroughly vented. Consider Sebastian Vent-Hoods which are built with precision, independently tested and engineered to work.

During processing, developer and stop bath contaminate fixer with silver producing a "spent-fix." The Environmental Protection Agency (EPA) and all other sewer codes require the silver be removed from spent-fix before disposal. After silver is removed, spent-fix is no longer considered a hazardous waste and may be conducted to the sewer. All effluent chemistry should be tested for "ph" and neutralized as necessary.

Mix concentrated liquid chemicals in a sink with a well-designed and correctly located vent-hood. Mixing chemical powders, however, must be done in a fume-hood. Check the MSDS to determine if a respirator, apron and gloves should be worn.

Daily removal of trash is very necessary to minimize odors. A schedule for regular, general cleaning should also be established and maintained. Each operator should be responsible for his or her area. An excellent practice to follow is "Clean as you go!"

A photo Darkroom must be universally accessible, be safe for teacher and students, and be designed and managed so that it is safe for the environment as well.

13. CONSIDER LIGHTING & ELECTRICAL

General lighting in the Finishing Room should be 5000 Kelvin in order to correctly judge color prints and transparencies. Fluorescent tubes rated at 5000 K are recommended.

Do not use fluorescent lighting in the Darkroom and Film Rooms because of the presence of "afterglow" when the lights are extinguished. White light is necessary in Darkrooms for orientation of new students, teacher demonstrations, maintenance and cleaning. Film Loading Rooms do not require safelight, but white light is necessary for cleaning.
Safelight in a print processing Darkroom is essential. Eastman Kodak Co. recommends "OC" filtration for black & white papers and #13 filtration for color papers. Thomas Instrumer Co. makes an overhead safelight that is ideal and adequately safelights large printing rooms. Their model "DUC" doubles as a safelight for both B&W and color papers, reflects, bounces safelight from a white ceiling 9'-6" high and covers an area 12 feet x 14 feet. Most other safelights are designed for small darkrooms.

Wall switches that control white lights in Darkrooms should have a "safety cover" to help prevent untimely exposure of sensitive materials. Overhead safelights are energized by a ceiling outlet (next to the safelight) which is controlled by a wall switch. A duplex outlet should be located at each enlarger station about 50" above the floor. A pedestal outlet is necessary under a sink where an automatic silver recover system is located. A duplex outlet should be positioned above a shelf (about 65" above the floor) at a sink where a timer is often located. Floor model film drying cabinets usually need an outlet about 85" above the floor. Remember to schedule the electrical requirements for processors you might include in your design.

14. SELECT THE RIGHT CASEWORK & EQUIPMENT

Select casework and equipment that is especially designed for teaching and learning photography. Choose institutional grade wall and base cabinets that will not only endure student abuse over many years, but will also give you the much needed unique features, enlarger booths, light baffles, light-tight drawers, drying screens, etc., your students need to easily and quickly accomplish their work. The highest quality durable casework on the market today is supplied by Sebastian Darkroom Products. It is wise to select sinks, washers and vent-hoods made of PVC for the outstanding reasons previously stated. Especially schedule vent-hoods that are correctly designed, tested and really work.

Use these major considerations to assist you in creating your dream photo facility, and you will be successful! With the help of your "design specialist," present a professional proposal and be prepared to defend your design when you face budget cuts. You know what you need and why you need it. Congratulations and good luck!