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ABSTRACT

Information is presented regarding--(1) types of audiovisual materials in the instructional program, (2) selection and placement of screens, (3) classroom acoustics and sound systems, (4) educational television, (5) provisions for nonprojected visuals, and (6) provisions for functional storage and storage within classrooms. Consideration is also given to planning for use of audiovisual materials in special rooms such as an audiovisual center, auditorium, gymnasium, cafeteria, speech and foreign language rooms, and science rooms. (FS)

PLANNING SCHOOLS FOR USE OF AUDIO-VISUAL INSTRUCTIONAL MATERIALS

THE UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT
Division of School Buildings and Grounds
ALBANY — 1959

Planning Schools For Use of AUDIOVISUAL Instructional Materials

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INTRODUCTION

This booklet is written to help people involved in the planning of school buildings.

The manuscript was written by Dr. Franklin T. Mathewson of White Plains after consulting many persons involved in the various phases of the program. He, of course, called on his own wealth of firsthand information. An advisory committee made up of specialists in the audiovisual field and school administrators was available to the author.

Dr. Paul T. Williams of the Bureau of Audio and Visual Aids and Basil L. Hick of the Division of School Buildings and Grounds have worked closely with the author in the preparation of the pamphlet. The manuscript was also reviewed by a number of technical experts for their comments.

We believe it suggests facilities that will allow for a greatly expanded use of audiovisual instructional materials.

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PLANNING SCHOOLS FOR USE OF AUDIOVISUAL INSTRUCTIONAL MATERIALS

Audiovisual techniques may be looked upon as symbolic of what is new and forward-looking in school programs. They are a basic, integral part of good teaching, a part of an ever-increasing body of knowledge about how people learn, and about how teachers can assist pupils to do a better job of learning in school. School plants in which adequate provision for audiovisual instruction has not been made are not likely to be suitable for the improved instructional procedures of today and tomorrow.

—*Planning Schools for Use of Audiovisual Materials No. 1, Classrooms.* Department of Audiovisual Instruction of the NEA

Audiovisual Materials in the Instructional Program

Probably no phase of education has changed so rapidly in the past few years—and may change so quickly in the immediate future—as the audiovisual equipment and materials for instruction. Within the last decade, new tools for education include the tape recorder, 16-mm. magnetic sound, diazo color transparencies, and closed-circuit television. The school year 1957-58 saw the introduction of 60-second photographic slides and zoom lenses. During 1958-59 the Board of Regents authorized the State Education Department to provide instruction by television over Channel 11 in New York City. Programs were telecast each schoolday from 9:00 a.m. to 5:00 p.m. and served schools within a radius of approximately 100 miles. Programs for school use were also telecast from commercial stations in several other areas of the State. These new developments in educational tools have a tremendous import for teaching methods and the facilities needed in school buildings. Schools are built for the future.

As far back as Comenius (1592-1670) outstanding educators have urged teachers to encourage pupils to learn by direct observation with the senses and not to rely on textbooks only.

Effectiveness of Audiovisual Techniques

Research proves that audiovisual materials, when properly used, are very effective instructional tools. Their use enables teachers to:

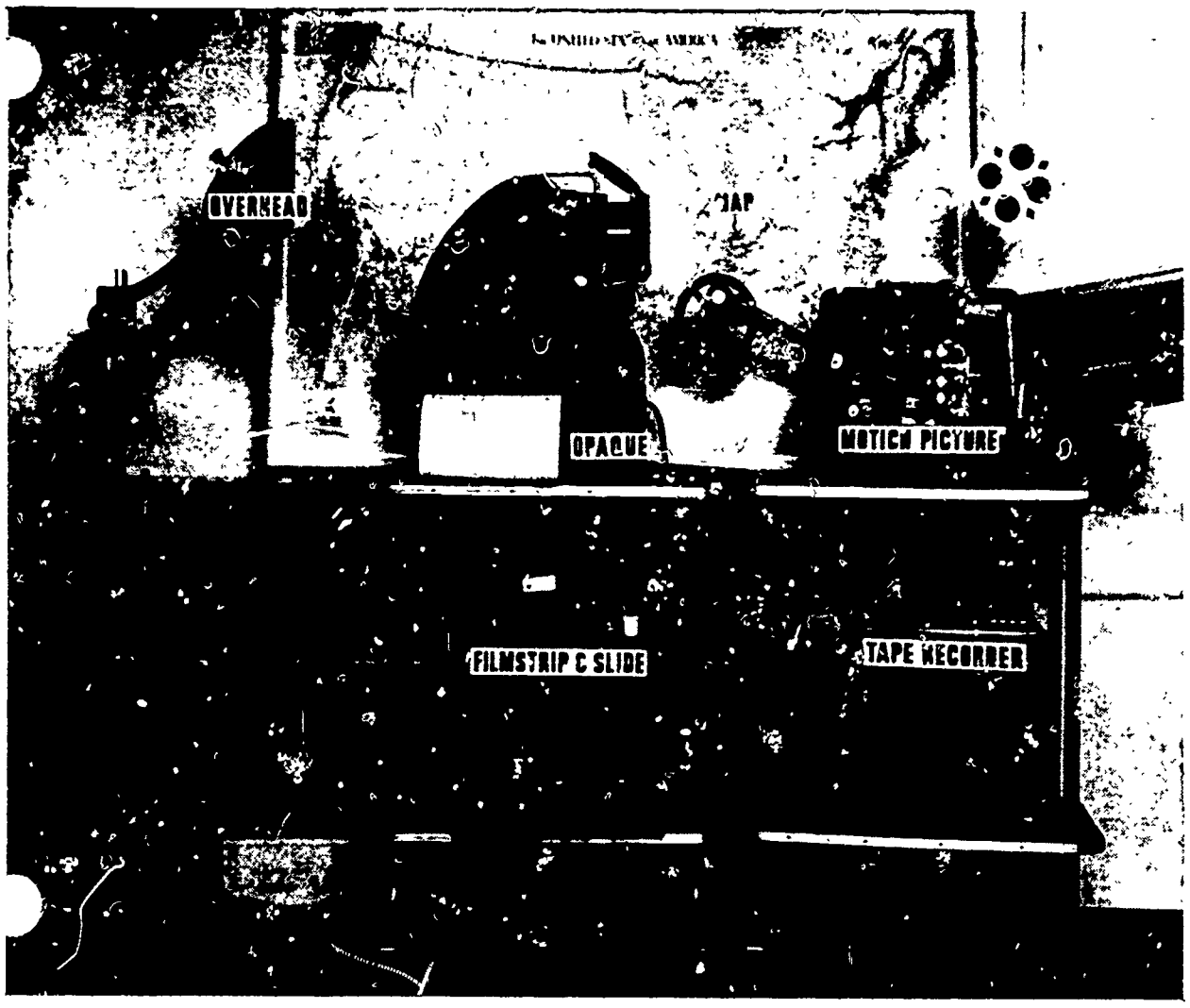
1. Focus attention
2. Reduce periods of instructional training about one-third
3. Present facts very efficiently
4. Provide better understanding
5. Insure longer retention of information
6. Motivate changes in attitudes
7. Widen horizons and interests

Audiovisual tools of learning make their best contributions to learning when used in the classroom, rather than in the auditorium or in a separate projection room. The psychological explanation of this is given later on page 23.

Audiovisual materials are versatile tools. With them the teacher can:

1. Bring large objects like atomic submarines into the classroom
2. Make small objects like bacteria large enough for all to see
3. Make rapid motion slow, as—for example--an explosion
4. Make slow motion rapid, picturing the opening of a flower by time-lapse photography
5. Make invisible objects understandable by animation, such as the flow of electricity
6. Bring distant lands and people to the classroom
7. Make past historical events seem real
8. Bring present events to the classroom as they occur, by radio and television
9. Enable students to hear themselves and others in language arts and music, for example, and thus improve their performance

Audiovisual materials are not used as an end in themselves. They are used to assist in achieving curriculum goals, not as an "audiovisual program" but as an integral part of the total instructional program. They do not take the place of reading; they stimulate purposeful research for more information. Audiovisual materials make the learning process more meaningful and concrete—not abstract, with words built upon words.



Various types of audiovisual equipment

VARIETY USED

A variety of audiovisual instructional tools should be used, depending on the educational objective. The following are examples of the three major types:

1. Projected visuals, including slides, filmstrips; opaque, micro, and overhead projectors; motion pictures and television
2. Audio tools, including record and transcription players, tape and disc recorders, public address and central sound systems, sound motion pictures and television
3. Nonprojected visuals, including pictures, charts, graphs, diagrams, posters, cartoons and maps; objects, models, specimens and diaramas; plays, puppets and role playing; field trips, experiments and demonstrations; chalk and tackboards

In planning schools particular attention should be given to electrical power and outlets for projected visuals and audio equipment; darkening

facilities for projection, acoustical treatment for audio tools, display facilities for nonprojected visuals, and storage facilities for all three types.

The Increasing Need

Today there is more to learn than yesterday, and there will be still more to learn tomorrow—more science and more history, for example—and more subjects are in the curriculum than formerly. Time is valuable. Teachers, just as engineers in industry and workers in other professions, can improve their work by using well the new tools available. Teachers must know how to operate the educational equipment and they need school buildings with facilities that encourage the efficient use of the materials. This brochure recommends how schools can be designed to further better teaching with both old and new audiovisual instructional materials.

PLANNING CLASSROOMS FOR USE OF AUDIOVISUAL MATERIALS

It is very likely that no area of a new school building will have as many varied and changing demands placed upon it in the next 5 to 10 years as will the "basic" classroom. Unfortunately, it is also probably true that no other single area of new buildings receives so little detailed attention from planners or is so poorly adapted in general to changing times in education.

—*Planning Schools for Use of Audiovisual Materials No. 1, Classrooms.* Department of Audiovisual Instruction of the NEA

Providing for Projected Visuals

The New York State Education Department, Division of School Buildings and Grounds, requires only that windows be a maximum of 30 inches from the floor and extend to 6 feet above the floor. Nine-foot ceilings are acceptable. Neither clerestory lighting nor the lighting of halls from classrooms is required.

In many school buildings the large amount of glassed areas make both light and heat difficult and expensive to control. All classroom glass wall areas need opaque coverings to exclude the light so that projected instructional materials can be effectively used. With the advances in artificial lighting we are not dependent on natural light for classroom activities—and the former is more easily controlled. It is difficult to control glare and shadows with sunlight. Rooms with a southern or western exposure become too hot except in cool weather, with accompanying fatigue and restlessness.

Controlling Light

Control of light in every classroom and shop is essential for physical comfort, the preservation of eyesight and for a good learning environ-

ment. At least 20 foot-candles of shadowfree and glarefree light must be maintained for reading and work areas. Only one-tenth of one foot-candle should fall on a projection screen according to the Committee on Non-Theatrical Equipment of the Society of Motion Picture Engineers. No ordinary shades, drapes or blinds can exclude natural light sufficiently. A statement of the latter committee follow :

Good tonal quality in the projected picture is impossible if the room in which it is being viewed is not adequately darkened. On the other hand, this does not mean that the room must be absolutely dark. Studies have indicated that a general room light in the order of one-tenth foot-candle is not harmful. This is a level of illumination under which it is difficult but not impossible to read ordinary newspaper type.

Aside from making provisions for excluding light from the room until the general level of illumination is at least as low as indicated above, it is particularly necessary to make sure that no narrow beams of light, especially sunlight, enter the room to produce bright spots on walls near screens, or to strike other objects in the room from which dazzling reflections will be thrown. For the comfort of the students the screen should be the brightest object in the room.

Light from corridors—that comes into the classroom through door windows, open display areas and glassed areas between classrooms and corridors—also needs control.

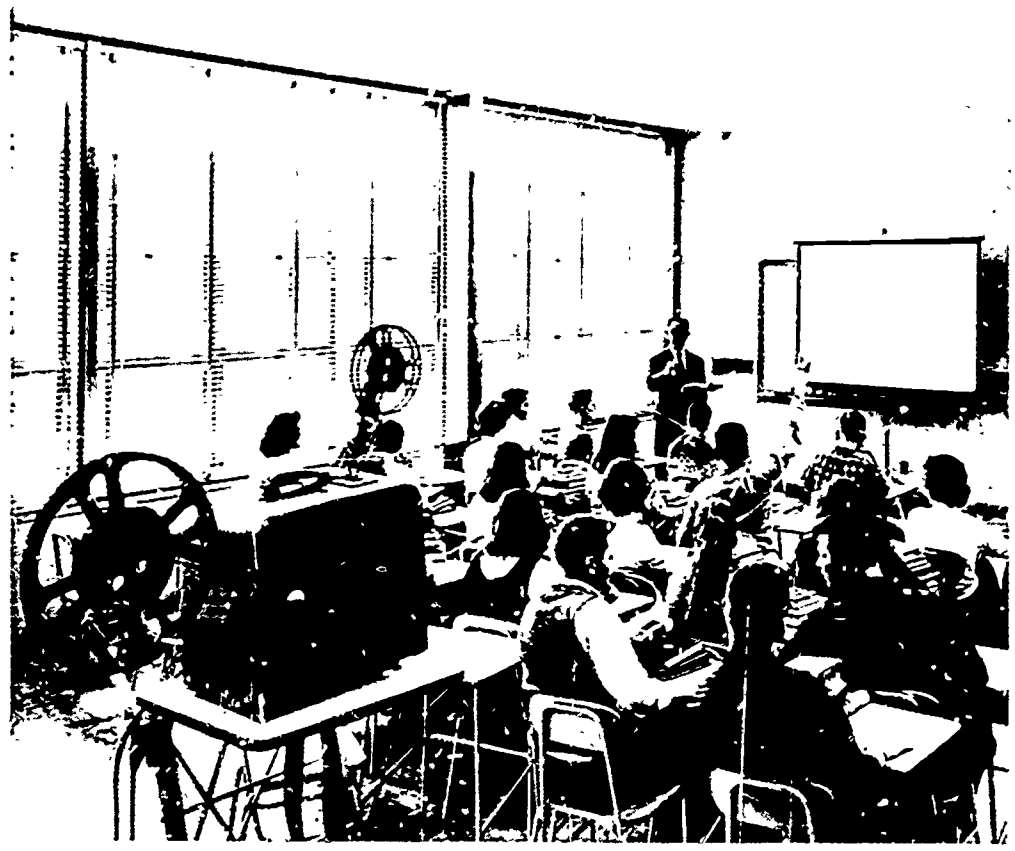
With some projected visuals, particularly slides and overhead transparencies with line drawings, up to one foot-candle can be directed downward on desks for note taking but this amount of light should not fall on the screen.

In today's schools it is customary for groups within a single class to work on different projects and to carry on different activities at the same time. Therefore at least four switches should control the artificial light sources in the classroom, each regulating a corner (not linear) quarter or less of the room. With such an arrangement one corner can be darkened partially for a group wishing to project a filmstrip or the front can be lighted for a play. The sides opposite the windows can supplement natural light or a back corner can be lighted when more brilliant line drawings are projected on the screen at the front of the room.

Excluding Natural Light

Three methods are commonly used to exclude natural light sufficiently to permit projection:

1. Full-closure, Venetian blinds
2. Opaque drapes of fireproof fabric or plastic materials
3. Opaque shades



Audiovisual blinds open

Audiovisual blinds closed

Full-closure blinds, using channels on all four sides, give both diffused lighting and sufficient darkening for projection. Installation of these audiovisual blinds and channels may not be a part of the building contract but provision should be made to facilitate later installation.

Opaque drapes for darkening usually require also translucent drapes, shades or regular venetian blinds to give desirable diffused natural light and protection from glare.

Opaque shades frequently are used in older buildings with individually spaced windows. These need channels or flaps to be effective and also need translucent shades in addition for diffused lighting.

Opaque darkening devices also are needed for clerestory lighting and for glassed areas sometimes placed between classrooms and corridors unless the latter have completely recessed lights that cannot shine into the classrooms. Skylights should also be provided with darkening devices.

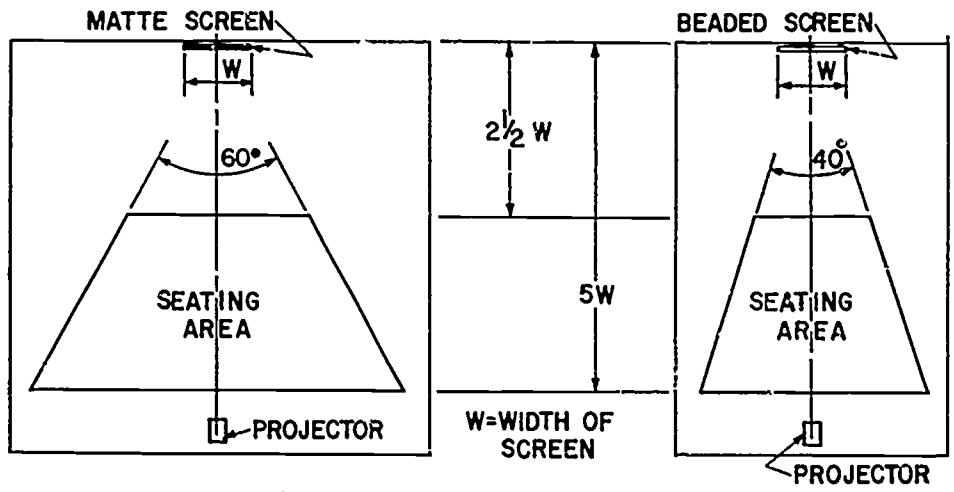
The publication, *Planning Schools for Use of Audiovisual Materials, No. 1, Classrooms* (revised 1958) published by the Department of Audiovisual Instruction of the NEA, gives more details of this important aspect of classroom planning on pages 21 to 28. It explains the advantages and disadvantages of the above methods of darkening and detailed information concerning their proper installation.

Ventilation

Ventilation is a serious problem that accompanies darkening. Natural ventilation blows drapes to some extent and particularly shades, admitting excess light. Full-closure blinds may not admit sufficient air with the classroom door closed. Each student gives off heat, water vapor and carbon dioxide which is enervating and a serious handicap to learning unless removed. Mechanical ventilation is recommended.

Selection and Placement of Screens

Adequate, well-placed screens are needed in each classroom. Matte surfaces should be used for wide nearly square rooms as they have a



wider angle of reflection. Beaded surfaces are better for screens in long, rectangular rooms as they reflect more light at a narrower angle. Metallized surfaces are best for the rarely used three-dimensional viewing, applicable to solid geometry. Students should not sit nearer than 1½ times the width of the picture projected or farther away from it than 5 times its width. The area at either side near the screen should not be used for viewing.

Screens should be hung permanently at the center front of the classroom. Audiovisual literature usually states that the bottom of the screen should be at eye level as the students sit at their desks in order that students at the rear of the group may have an unobstructed view of the picture screened. If the room has movable seats so that an area in front of the screen can be cleared and chairs adjusted to avoid obstructions to vision, it is more comfortable and conducive to observation if a point one-third from the bottom of the screen is at eye level. The small screens and maps formerly used could be hung from a display rail on the top border of the chalkboard. The large maps and screens (70″ x 70″) now recommended obviously need to be hung from a display or hook rail considerably above the top border of the chalkboard.

Screens to be used frequently with overhead projectors should be suspended out from the wall about 18 inches on brackets. By fastening

Correct level for hanging screens and maps

the bottom of the screen to the wall, the surface of the screen is slanted to avoid the "keystone" distortion effect caused by the tilting of a projector near to the screen.

Screens for Daylight Projection

For decades educators have been promised screens that could be used in rooms not having darkening facilities. Improvements have been made but the goal seems far from being reached. Portable shadow boxes are useful for small group or individual student use but they are far too bulky when approaching the size desirable for an entire class. Built-in shadow boxes are usually much smaller than the 70 inches x 70 inches recommended for screens.

Translucent rear screen projection for general classroom use has proved unsatisfactory for many years although it is useful for limited space exhibits and television backgrounds.

The newest developments, refracting and lenticular surfaces, give a much better picture than standard screens in a lighted room, but they are smaller, usually must be tilted downward, be stretched tightly and sometimes require a complete, solid, inflexible frame which makes them much less convenient to use.

There is no adequate substitute for darkening classrooms so that no more than one-tenth foot-candle of light falls on a large screen.

Electrical Energy

Just as in the home, the schoolroom needs more electrical energy and more outlets than in past years. Each classroom needs outlets with a total minimum of 15 amperes (1,700 watts). The wattage of projector lamps has been stepped up from 150 to 1,200 watts in the past 15 years—and many more pieces of equipment are now more frequently used. In many of our older buildings teachers in adjoining rooms cannot use projectors at the same time without blowing a fuse. If three rooms are placed on the same circuit it should be fused, or have a capacity of 45 amperes. The Department of Audiovisual Instruction of the NEA recommends 20 amperes for each classroom. Lines should provide at least 110 volts under full load.

Double outlets should be placed on all four sides of the classroom and should be placed above work counters where these are installed. The outlets should be on a separate circuit from the room lighting.

Providing for the Use of Audio Materials

Some 35 years ago no electronic audio tools were used in the classroom—now they have become many of our most effective devices.

Acoustics

There is little use in producing sound if it cannot be received properly by the ear. Most of the children's time is spent in the classroom and professional attention should be given to its acoustical treatment. Reverberation times should conform to the acceptable standards.

Frequently walls and ceilings are so thin that the audio activities of one room interfere with adjoining rooms. Recessed central sound system speakers should be avoided as they often have such a thin wall back of them that they severely annoy the next room.

An acoustical treatment of corridors promotes concentration in the classroom.

Central Sound System

A central sound system is recommended for all schools, elementary and secondary, unless the building is completely served by television. Speakers should feed all classrooms, corridors, bus loading areas, playgrounds, gymnasiums, cafeterias, the auditorium; i.e., the entire building and the campus.

The following are some of the educational uses of a central sound system:

1. By students, for morning student newscast, school activity announcements and reports, student government activities and student musical programs before school, at dismissal, and noon broadcasts (both live and recorded)
2. By teachers, for the FM School of the Air, events of national and world importance, and as motivation for research, good writing, correct speech and rehearsals for the student activities listed just above
3. By administrators, for announcing curricular and extracurricular activities, new regulations or disciplinary action, changes in schedule and directions on playgrounds, at bus loading depots, or in emergencies

The system should be equipped with reproducers to attain the highest possible level of performance. These reproducers shall be supplied with grills that permit diffusing of the higher frequencies and the metal electracoustic housings shall be precisely engineered for size to give the best support reproducer action eliminating vibrations. For the classroom to receive a true and faithful reproduction of voice and music it is suggested that the reproducer be mounted rather high in one corner of the room.

The console control. or central control rack, should be placed in a room off the central administrative or audiovisual coordinator's office, not in the principal's office, in order to serve educational as well as administrative purposes.

The central sound system should have FM and AM radio tuners with outside antennae, a four-speed automatic record player and a tape recorder built in as an integral part of the system, as well as extended-range amplifiers and microphone mixers. If portable radios with inside aerials are to be used. each fluorescent light fixture should be wired with a condenser suppressor to avoid "static" interference.

The system can include facilities for a secondary fire alarm system. This with the programing and communication facilities can be all integrated in a single conduit and wired system. The primary fire alarm system, however, still must be provided within its own conduit.

Inputs for microphones to feed the sound system should be considered for several locations such as the principal's office, the central administrative office, the auditorium stage, cafeteria, gymnasium, library. speech and music rooms, and at the console or central rack.

High-impedance microphones installed at distances from the console or central control rack will have a tendency to pick up hum and have high-frequency losses. Therefore, it is suggested that low-impedance microphones should be used as follows:

1. Principal's office, central administrative office, library—low-impedance all-directional dynamic microphone with a frequency response of 60-12,000 cycles
2. Gymnasium—low-impedance cardiod dynamic microphone with a frequency response of 40-15,000 cycles
3. Auditorium stage—a gradient ribbon bidirectional low-impedance microphone with a frequency response of 40-15,000 cycles

Telephones—not intercoms—should be used for two-way communication between rooms and with administrative offices. Intercoms usually have a poor quality of reproduction and cannot satisfactorily be used as a central sound system. Used as a substitute for a telephone there is no privacy of conversation between the principal and the teacher, and it disrupts the concentration of the class. If "talk-back" is required for closed-circuit television, beyond that afforded by the telephone system, a low impedance microphone input may be placed in classrooms.

Educational Television

Careful consideration should be given to the future use of television in schools. Beginning in September 1958 the State Education Depart-

ment was authorized by the Board of Regents to telecast educational programs over Channel 11 in New York City. These programs are available for inschool use from 9 a.m. to 5 p.m. each schoolday and can be received by most schools within a radius of 100 miles of New York City. Less frequent educational programs are also being telecast over commercial stations in the Buffalo, Rochester, Watertown and Albany-Schenectady-Troy areas.

The FCC has approved the Board of Regents' plans for UHF educational television stations in the Utica, Syracuse, Rochester, Buffalo, Binghamton, Ithaca, New York City, Malone, Poughkeepsie and the Albany-Schenectady-Troy areas. These stations can serve the schools of their area soon after the money for their construction and operation is authorized by the State Legislature.

Schools are also making progress with closed-circuit television. The Board of Regents is sponsoring experiments with closed-circuit in the State University College of Education at Albany and at Brockport and in a combination of three neighboring school systems including the city school district of Cortland and the central school districts of Virgil and Truxton.

The first step in school planning for the use of television is the construction of a master antennae system. From the antennae on the roof or other elevated point the signals are amplified and fed through a control panel. From this panel the various channel programs are distributed to the classrooms by coaxial cables. Television receivers plug into the coaxial outlets for good strong signals. A conduit is needed for the coaxial cable which is one-quarter inch in diameter.

For closed-circuit television a studio of approximately 1,200 square feet should be provided, with a control room of about 300 square feet for control panels, monitors and a film chain. At the other end of the studio or nearby there should be an area of approximately 300 square feet for storing properties. The closed-circuit programs may be carried to the various rooms over the same coaxial cable used for the distribution of the telecast programs mentioned above, by employing any of the unused channels. Closed-circuit programs may be carried to other school buildings or other school systems by coaxial cables.

Other points in the school building for originating programs might be considered but the cost should be commensurate with the contribution to the educational program. Each point of program origination will require its own coaxial cable to the master control panel, some 200 foot-candles of illumination, acoustical treatment and a suitable location for the cameras.

Educational television is recommended for use in the classroom rather than the auditorium or a special room. The reasons are the same as those given for projected visuals which are explained on page 23. Two 24-inch picture tubes are recommended for each normal-sized classroom. The viewing angle is at least as good as for matte screens. A maximum angle of 35 degrees from either side of center is usually satisfactory. The minimum distance from television picture tube to the viewer is about five times the width of the "screen" and the maximum recommended distance is ten times the "screen" width. This would amount to seating students no nearer than 10 feet or farther than 20 feet from the 24-inch picture tubes suggested above.

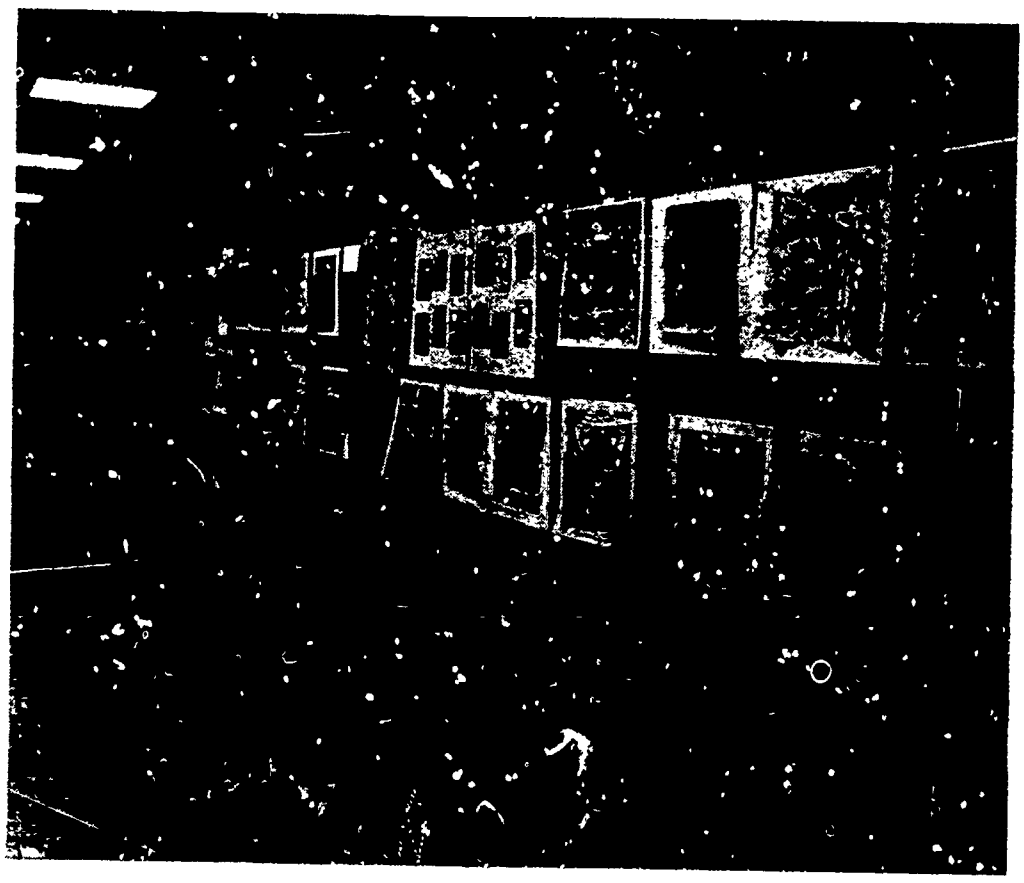
Providing for Nonprojected Visuals

Nonprojected visual materials still are important educational tools. Chalkboards and tackboards (bulletin) should be in all classrooms. They should be well lighted with no glare. The relative proportion of each should be easily changed to meet the needs of various grades and the desires of different teachers who might use the rooms. Lower grades usually need more tackboards and less chalkboards than the upper grades. Pegboard areas are also useful.

Map or hook rails formerly placed along the top border frames of chalkboards, for the support of maps and the projection screen, should now be installed at some distance above the chalkboard frame. In general, materials should be displayed at eye level. Audiovisual literature usually states that the bottom of maps and the projection screen should be at eye level so as not to interfere with the view of students at the rear of the room. This is undoubtedly true for rooms with fixed seats (or in cases where teachers do not encourage the children to move the seats). If the space in front of the maps and the screen can be cleared so as not to interfere with vision it is physically more desirable to have these materials suspended so that a point about one-third up is at eye level.

Horizontal display areas should be provided for three-dimensional materials. These may include the workcounter, regular shelving, pegboard, an enlargement of the bookcase and recessed pullout or hinged swingdown display shelves. Classroom display areas visible from the corridor are sometimes used in buildings but neither the display nor the hall lighting should interfere with darkening the room for projection.

A work space for instructional projects should be provided along one side of the classroom. It should have a no-splash sink, hot and cold



Two methods of corridor display

water and an overflow control. Electrical outlets should be nearby, several inches above the level of the counter.

Providing Functional Storage

Audiovisual equipment and materials should be easily accessible to teachers in order to save valuable time and encourage its good educational use. Heavy equipment such as motion picture, opaque and overhead projectors, and tape recorders should be installed fully assembled, ready to plug in and operate, on rolling projection stands. These stands should be 3 feet to 3½ feet high with a top area about 18 inches x 24 inches, and roll on rubber-tired wheels not less than 3 inches in diameter, equipped with braking facilities.

Until such times as citizens feel that individual classrooms should be supplied with the above equipment, it should be wheeled into storage rooms opening off supervised areas such as the central administrative office (or office of the immediate area), library or the building audiovisual coordinator's office. Equipment storage rooms should be conveniently located and the following arrangements are possibilities:

1. On each floor if the building has more than one level
2. In units if a campus type of building
3. Perhaps by departments in some secondary schools
4. Plus a central reserve area

Equipment storage rooms should have good tumbler locks. All door sills in the building should be flush with the floor to facilitate the movement of heavy equipment mounted on the rolling projection stands.

The amount of storage space needed will depend on the nature and frequency of use of the equipment. Equipment needs are stated in audiovisual literature in terms of the number of teachers or pupils it might be expected to serve. However, this publication deals with buildings rather than personnel so the storage given in the table below is in terms of the need by number of classrooms.

Audiovisual materials also should be stored and filed so that teachers may have easy access to them. The teacher will keep some of these in her own room if she uses them frequently. Materials for general use may be filed in the library, by departments in secondary schools, off the general or area office, or in connection with the audiovisual coordinator's office.

TABLE I

Audiovisual Storage Space Required for Minimum Equipment

EQUIPMENT	APPROX. NO. ROOMS SERVED[1]	APPROX. STORAGE DIMENSIONS (INCHES) LONG	WIDE	HIGH	APPROX. VOL. IN CU. FT.
Motion picture	8	24	12	18	3
Filmstrip & 2" x 2" slide	6	1?	10	12	1½
Standard slide (3¼" x 4")	14	30	10	18	3
Opaque projector	14	24	15	30	6
Overhead projector[2]	14	24	18	30	7
Radio, if no cent. sound	5	20	12	18	2
Record player (one each K-3, then 3)		18	18	12	2
Transcription player	10	22	22	16	4
Tape Recorder	10	18	18	12	2
Screens, port. tripod[3]	14	74	6	6	1½
Microphones & cables	10	12	12	6	½
Microphone stands	10	12	12	36	3
Stereoscopes[4] 35 per	10	6	6	3	(35) 2
Television, portable[5]	3	30	30	30	9
Projection stands, roll.	3	30	20	42	13

[1] At least one per school if building has fewer rooms than indicated

[2] For secondary schools

[3] In addition permanent screens in each room

[4] For elementary schools and solid geometry

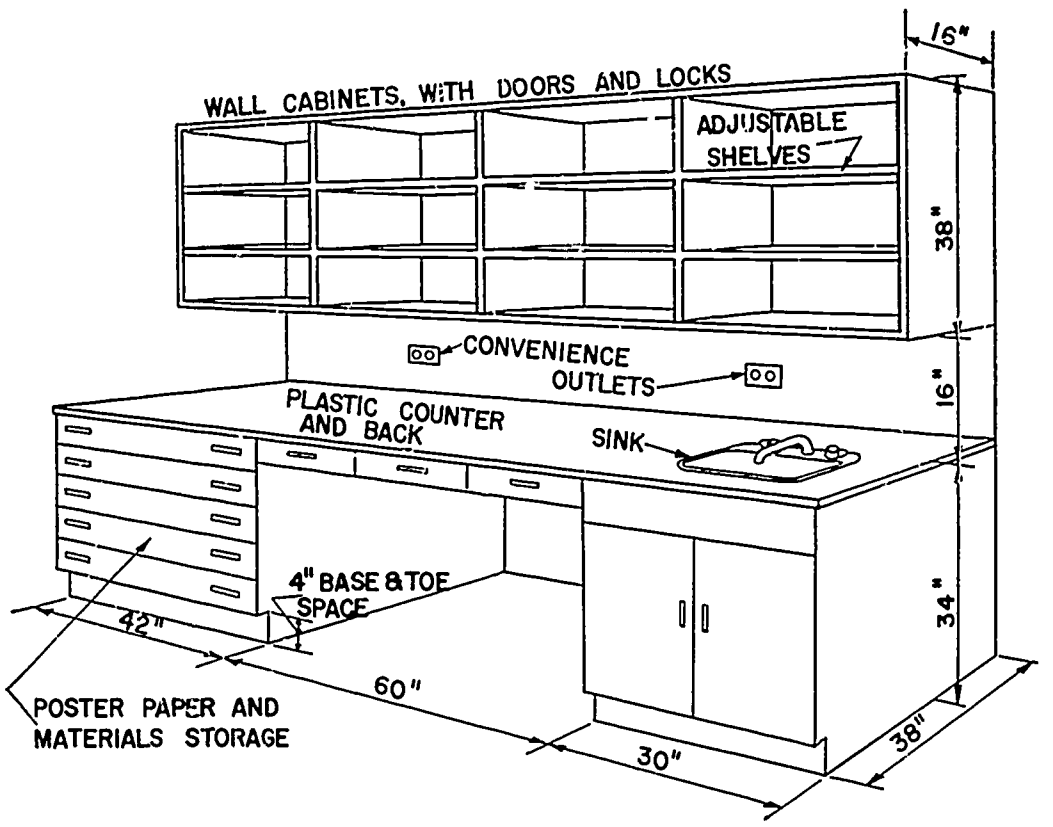
[5] If permanent installation is not made or closed circuit not used

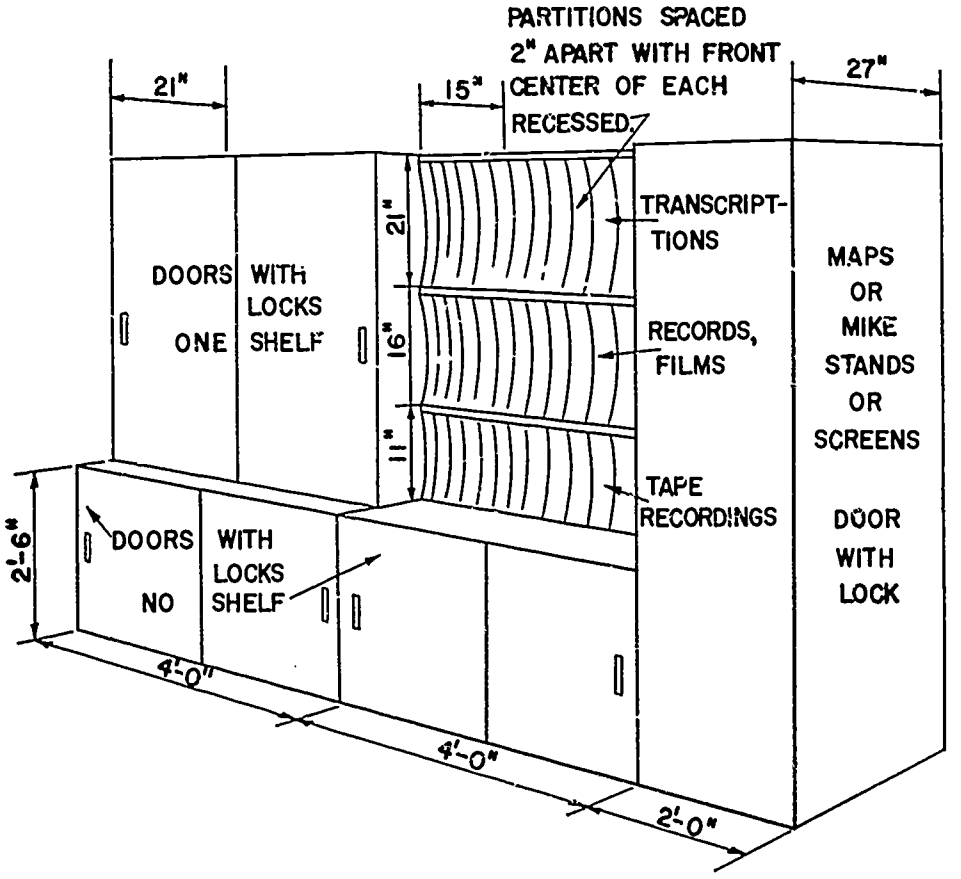
Storage Within Classrooms

Some equipment semipermanently assigned to rooms will need storage there. The amount so assigned is steadily increasing as teachers make more frequent use of it. Each room should be supplied with a minimum of:

1. A legal-size file cabinet
2. A cabinet with wide deep drawers for pictures, posters and charts up to 36 by 40 inches
3. A cupboard with assorted height shelves for paints, brushes, stereoscopes and miscellaneous supplies

A small shelf which can be lowered to form a built-in projection stand may be hinged in the wall at the back of the room.


16"
WALL CABINETS, WITH DOORS AND LOCKS
ADJUSTABLE SHELVES
38"
CONVENIENCE OUTLETS
16"
PLASTIC COUNTER AND BACK
SINK
4" BASE & TOE SPACE
34"
42"
60"
POSTER PAPER AND MATERIALS STORAGE
30"
38"


PARTITIONS SPACED 2" APART WITH FRONT CENTER OF EACH RECESSED.
21"
15"
27"
DOORS WITH LOCKS ONE SHELF
21"
16"
11"
TRANSCRIPT-TIONS
RECORDS, FILMS
TAPE RECORDINGS
MAPS OR MIKE STANDS OR SCREENS
DOOR WITH LOCK
2'-6"
DOORS WITH LOCKS NO SHELF
4'-0"
4'-0"
2'-0"

Planning for Use of Audiovisual Materials in Special Rooms

Although the best use of audiovisual instructional materials is usually in the regular classroom, these materials have uses that require particular attention in certain other rooms in the school.

The Audiovisual Center

Larger schools need full-time, and smaller schools part-time, audiovisual or instructional materials coordinators. They assist teachers and administrators by:

1. Promoting the good educational use of materials
2. Locating and obtaining new instructional materials
3. Instructing teachers and projection crew members in the operation of equipment
4. Producing and/or assisting other teachers in the production of local audiovisual materials for instruction and public information
5. Administering a library of audiovisual literature, catalogs and various types of audiovisual instructional materials
6. Administering the equipment pool, including the supervision of departmental or area "substations," scheduling its use and supervising repairs
7. Administering the central sound or television system

In order to perform these functions the audiovisual center should be located conveniently for the teachers, near the library or the administrative offices. The center should contain:

1. An office with a desk, table, files and bookcase
2. A workroom with a workbench, vise, water, gas and at least four double outlets for electricity; with storage for tools, poster paints, brushes, plaster of paris, construction paper, poster board, plywood; photographic lights, cameras, film etc.
3. A photographic darkroom available in secondary schools
4. An instructional materials storage room with files and racks for films, slides, transparencies, maps, audiovisual books, records, filmstrips, catalogs etc.—probably as a part of the outer office with a table, desk and files for a secretary
5. An equipment storage room, possibly in connection with the workroom (2). The amount of space will depend upon the extent of the decentralization but lower shelves should be 30 inches high with no sills for heavier and bulkier equipment, and others spaced 18 inches and less. (See table I, page 20, for assistance in estimating the total amount of storage space needed.)

6. The school television studio, control room, boom microphones, TV cameras, a projection chain and space for property storage
7. A small studio with adjoining central sound-system controls (in the absence of closed-circuit television (6))
8. An audio workroom, either in connection with the central sound, the television audio or the general workroom, with workspace for equipment to dub tape to discs, tape to tape, discs to tape and discs to discs.
9. A small previewing and prelistening room

Item 8 may not be necessary if these services are available from a districtwide service to all schools.

Audiovisual Class Projection Rooms

It costs less to darken each classroom and provide the needed equipment than it does to construct a projection room. For less money the students are given a more effective use of materials in their own classrooms.

Audiovisual class projection rooms are discouraged for sound educational reasons. When a group moves out of its classroom to the auditorium or the projection room a holiday atmosphere tends to develop. Students expect to be entertained, not to learn. The classroom is the natural learning environment; it has the chalkboard for listing questions to which the students should seek answers in the film, the maps that students may wish to observe before the film or during the discussion afterwards and the class projects related to the subject being studied.

Because of the increasing use of a variety of projected materials there will be many times when more than one teacher will wish to use the projection room at the same time. More than one room is therefore frequently needed so that the teacher may use the instructional materials at the best psychological time for her pupils.

There are some occasions when large groups may be shown pictures in the auditorium if there is not too large a span in their age and interests. For example, such showings might be at holiday seasons, during safety campaigns or for pure entertainment. Perhaps we should do more in developing discriminating tastes in motion pictures. However, the major objects of the curriculum are served best when the teacher uses the projected materials, just as the other instructional tools, with his own class in its own classroom.

Audiovisual Equipment in the Auditorium

Audiovisual materials and equipment have their special functions in the auditorium as mentioned briefly above—but it is not a substitute for the classroom. However some of the same basic equipment principles apply.

AUDITORIUM PROJECTION

Darkening problems are easily handled in most new auditoriums by omitting all windows and employing mechanical ventilation. Where windows do exist they should be covered by opaque, fireproof, fabric or plastic drapes. They should overlap at least one foot, hang well below the windows, and be covered at the top by a wooden valance.

Screens should have a beaded surface for narrow rectangular auditoriums and a matte surface for wide square-shaped areas. The screen should be hung so that students seated at the front sides of the auditorium can see all of the screen. However, the students seated in the front row should not be seated nearer than 2½ times the width of the screen. It should be large enough so no students will be seated farther from the screen than 5 times its width. A square-shaped screen is desirable but this factor should not limit the width necessary to meet the needs of the students in the back of the room. Auditorium ceilings and proscenium arches should be high enough to accommodate an adequate screen.

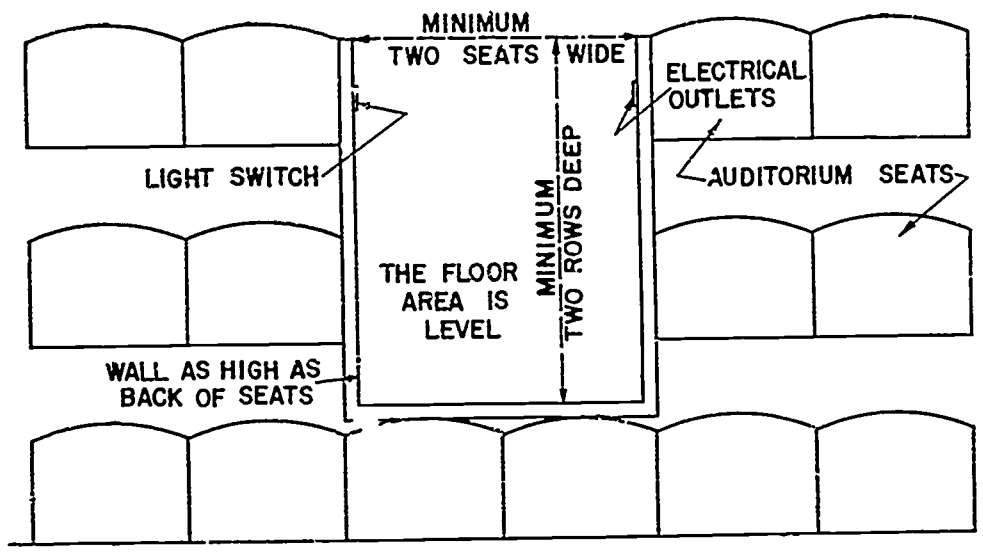
Auditoriums seating over 1,000 persons should have a projection booth; smaller ones should have a projection alcove or niche at the back of the auditorium on a modest elevation, approached by a ramp to accommodate rolling projection stands. A projection area can be provided in the place of four or more seats at the center rear of the auditorium, as shown in the diagram.

ELECTRICAL ENERGY AND CONTROLS

Double electrical outlets for audiovisual equipment, fed by multiple circuits independent of the house lights and fused for 30 amperes, should be placed:

1. Every four feet along the base at the front of the stage
2. At least two in each wing of the stage
3. Two at the back of the auditorium and one halfway back, or one one-third and one two-thirds of the way back in larger auditoriums.
4. Four in the projection booth or two in projection niche or alcove

One wing of the stage should have an enclosed booth or cage in which should be housed controls for the central sound or television system, public address, and recording equipment and perhaps a set of



controls for the curtain, screen and lights. At least all these controls should be in the same wing. Controls for many of these items should also be considered for the projection booth and to a lesser degree for the projection alcove. At the minimum one set of auditorium lights should be under the control of either the booth or the alcove, whichever is used. There should also be telephone or intercom communication between these points and the stage control center.

AUDITORIUM SOUND

Careful attention should be given to the many acoustical problems in auditoriums. High-fidelity tweeter and woofer, multiple speakers, well baffled should have permanent installation. They should be wired with inputs so that they may be fed by the central sound system, public address, motion picture projector, record player and tape recorder player without stringing long connecting cords. The power outlets at the front (center), back and intermediate points in the auditorium, and in the booth or alcove should have placed beside them inputs for sound from audio equipment, with speaker cables leading to an amplifier and thence to the permanent speakers.

Permanent shielded microphone cables for low-impedance microphones should be installed every 10 feet across the front of the stage; one in the back center, and provision for one to be lowered to the center of the stage. Similar microphone inputs should also be installed at the center front and the center back of the auditorium proper, and halfway or one-third and two-thirds the way down all the aisles—for audience participation. All inputs for microphones should lead to the central sound or auditorium public address system and thence to the permanent speakers.

Conduits could be installed to permit the origination of closed-circuit television from the stage. With this facility, assembly programs may be carried to all the students in the school, even though the auditorium will not seat them.

Audio Equipment in the Gymnasium

Gymnasiums, with their usual hard walls, floors and ceilings, reflect much of the loud noise created there. Because of the reverberation it is very difficult to understand commands and the calls for square dancing and other activities. Therefore considerable acoustical treatment is necessary.

In order to give a more even distribution of music and speech several speakers should be placed in the ceiling or the corners. The local transcription player with tempo control and microphone input should play through these speakers as well as the central sound system. In divided gymnasiums, permanently installed wires from the speakers to audio inputs should be provided in both parts of the room with switches to control the speakers needed.

Gymnasiums are also used for fairs, exhibits, bazaars and social activities and therefore it is suggested that electrical outlets be installed about 20 feet apart on all sides of the room.

Audio Equipment in the Cafeteria

The cafeteria is another noisy place and needs considerable acoustical treatment to help promote a restful luncheon period. Cafeterias are used for banquets, PTA meetings, overflow from the auditorium etc. and therefore need a good speaker system. Several properly placed speakers are suggested. There should be a microphone input for the central sound system at each end of larger cafeterias, or an audio input so that a local amplifier with microphone can use the permanent speakers.

Audiovisual Equipment in Musicrooms

The problem of acoustics in the musicroom is not that of "deadening" the sound (reducing the reverberation) as in the cafeteria and gymnasium, but rather its natural rendition. Some musicrooms are constructed in trapezoidal shape with no walls parallel. Excellent high-fidelity, well-baffled speakers are essential, the number depending upon the size of the room. The high-fidelity musicroom transcription player and tape recorder should also play through these permanent superior speakers as well as the central sound system.

Several microphone inputs with mixing facilities should be located across the front of the room. The output of these should feed into the local tape recorder or the central sound system.

Darkening facilities are required as in regular classrooms. These might be opaque drapes to assist in controlling acoustics as well.

Audiovisual Equipment in Speech Rooms

Acoustical treatment is again in order. Multiple microphone inputs should be placed across the front of the stage and one located at the back of the room. These inputs should lead to a mixer and then to the local tape recorder and the central sound system. Darkening facilities as recommended for other classrooms are needed.

Audiovisual Equipment in Foreign Language Rooms

The State Education Department recommends the *classroom-laboratory* in which the teacher can use electronic equipment some 10-20 minutes each class period. This equipment includes a tape and a disc player of high quality with outputs wired to all individual pupil stations at which good quality headphones with volume controls are located. Activated microphones, providing simultaneous hearing through the headphones, should also be provided at each pupil station. Low partitions to form individual booths are desirable but not essential. Front partitions should not be high enough to preclude the use of visual materials. Teachers may monitor individual students through switches at a console or simply by moving about the room. The more complete laboratory, using (in addition) individual student recording and playback facilities with multiple input channels is better adapted for third and fourth year language students, or for independent language practice in a smaller room off the language office or the library. Special attention should be given to acoustical treatment and ventilation. Darkening facilities should equal those recommended for classrooms.

Audiovisual Equipment in Science Rooms

Secondary science rooms need electrical outlets for each two students. It should be possible to darken science rooms even more completely than regular classrooms. in order to perform experiments with light and to use the microprojector.

Other Special Classrooms

Other special classrooms such as art, home economics, shops etc. need darkening facilities for the projection of pictures, adequate electrical power and outlets, acoustical consideration for the use of audio materials, and display and storage space just as other classrooms.