A PLAN FOR THE HIGH SCHOOL GYMNASIUM

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TABLE OF CONTENTS

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CHAPTER I

INTRODUCTION

Statement of the Problem

In recent years, the school administrator has been giving more attention to problems of gymnasium construction, maintenance, and equipment. Postwar plans for gymnasium construction now exist in various stages of development in the state of Oregon. Some plans await release of critical materials, some need government approval, some require a vote on a bond issue to provide the necessary building funds, some are still preliminary sketches in the architects' office, while others are still "just ideas." Speculation on postwar problems should be encouraged in the hope that adequate provision will be made for physical education and recreation in the future. At whatever stage these plans may be, the administrator, the building committee, and the teachers who will use these facilities should be concerned with the functional design of such a unit. The best results are obtained when requirements are studied by all those interested, including teachers who are to use the facilities. While the architect is charged with the design and mechanical

perfection of the building, its over-all plan and utilization in terms of educational needs is a responsibility of the school administration.

This paper seeks to gather and select pertinent information on standards, policies, and procedures in gymnasium planning, adaptable for use by schools in the state of Oregon.

Purpose of the Study

The Oregon State Legislature in the year of 1945 enacted the compulsory Health and Physical Education program. The law, in part, states:

> The board of directors of all school districts of the state of Oregon shall provide in their respective schools, programs of health instruction and physical education for the development of health and physical fitness for all elementary and high school pupils in such schools.[1]

To meet the requirements of this act, many school districts will be encouraged to improve their gymnasium and physical education facilities.

The present day emphasis on better physical education programs and facilities is a result of information gathered on physical defects in the youth of the nation

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[1]Oregon Compiled Laws Annotated, Chapter 316, Section 1, Paragraph 1.

when we tried to build an army during World War II. A surprising number of young men had physical defects that rendered them unfit for military service. Consequently, "physical fitness" programs were inaugurated in the schools, placing the emphasis on physical development and conditioning. However, these programs had other important benefits, such as mental health, stamina, endurance, and skill which have all been recognized as worthwhile and necessary in giving young people a proper educational background. Therefore, school boards and administrators are beginning to realize the need for new buildings and equipment that will make possible a satisfactory curriculum of physical activities.

Another factor, making adequate gymnasium facilities essential in recent years, is the increased interest in recreation along with sports and athletics. More and more, the need for recreational activities and sports that will carry over into adult life, is being recognized by educators planning the school curriculum. It is necessary to physical, mental and social health to have recreational interests all through life. Whenever possible, the schools must develop recreation skills and interests that will be of permanent value to the individual. The schools can do this more adequately if they have well-equipped physical education plants.

Finally, consideration should be given to community use as well as school use of the recreational facilities of the gymnasium. The same fundamental principles of design may be applied to both school use and community use. However, if the school facilities are to be used by the public, the best possible design and the widest possible use of the facilities should be planned. Thus, the schools will provide for an adequate program of recreation and leisure-time activities.

Source of Material

The sources of the material for this paper are principally periodicals and books found in various libraries.

Through The Readers' Guide, articles relating to gymnasium planning and construction were located. The State Department of Education supplied a limited amount of information. Through the committee functioning for the State Department of Education in an effort to establish standards and make recommendations, much valuable data was received. From the State Library in Salem, Physical Education Facilities for the Modern Junior and Senior High School by Herbert Blair, and Standards for High School Building by N. L. Engelhardt, were obtained.

Much information was obtained from the American School Board Journal, Nation's Schools, and to a lesser extent, Architectural Record, Architectural Forum and numerous other periodicals.

The American School and University was also an excellent reference.

CHAPTER II

GYMNASIUM BUILDING

Single vs. Combination Unit

In general, there are two types of gymnasium plans: (1) the gymnasium for gymnasium purposes, and (2) the combination of the gymnasium with an auditorium or stage. The building committee is often confronted with making a choice between these two, and unfortunately, the decision is frequently arrived at without due consideration of the many factors involved. Often the choice is made on the basis of economy and without due respect to the best educational practices. This choice depends largely upon the individual community needs and desires. Authorities agree, however, that the most desirable and sound solution rests in planning and constructing the gymnasium as a unit unto itself. This position is supported by responsible persons who have studied the relative merits of various types.

Alice Barrows[2], former specialist in School Building Problems in the U. S. Office of Education, criticizes

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[2] Alice Barrows, The Combined Auditorium-Gymnasium (The American School and University), p. 291, 1938 Annual.

combination units in these words:

> "I have never known a school superintendent or principal who did not agree that a combined auditorium and gymnasium is unsatisfactory for use either as an auditorium or as a gymnasium."

Dr. N. L. Engelhardt, well-known educational consultant, in discussing gymnasium planning, forsees the trend in these words:

> The schools will tackle earnestly this job of building sound men and women as it never has in the past.....Inadequate and insufficient recreational and body-building facilities will not be countenanced. Gymnasiums, note the plural, will be parts of the school plant. They will not be merely innertubes of auditoriums but will be planned for an all-day evening service in body-building.[3]

It is well to examine some of the points which differentiate these two types of facilities, to see what makes them suitable for one function and impractical for another. First is the problem of usage. For example: The dramatic department wants to use the stage for practice during the sixth-period physical education class; or the members of the debating team need to orient themselves to the auditorium, but basketball practice is under way; or the girls' gym class during the seventh

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[3]N. L. Engelhardt, The Impact of War Upon School-Building Planning (The American School and University), p. 14, 1942 Annual.

period has to be called off because the orchestra must rehearse.

Another disadvantage of the combination unit is evident where the gymnasium floor serves as the seating area for student assemblies. The chairs needed have a high initial cost and then subsequent cost of repairs and replacements. Handling of the chairs for each assembly, and the use of chairs on the floor adds to the maintenance problem, as the shoes of the occupants leave their marks on the floor.

The element of safety is another factor to be considered. The combination unit increases hazards rather than reduces them. The stage and its projections are usually too close to the playing area. The electrical and fragile equipment required for the stage may be easily damaged by normal playing activity. Unprotected windows, curtains, stage props and accoustical materials can not avoid being hit by balls.

These elements should be carefully considered when planning the gymnasium. Avoidance of these difficulties lies in the independent gymnasium unit.

Location of the Gymnasium Building

The location of the gymnasium will conform to the general plans for the entire school plant. Wise planning

will locate the gymnasium unit so that it is easily accessible and has its own outside entrance. While the unit does not need to be detached from the main building, it is desirable to establish the gymnasium as a wing, preferably with the main floor at ground level. This arrangement permits the use of this unit without opening the entire school building and at the same time localizing the noise usually present. The building should be easily accessible from both classrooms and the athletic field and a southern exposure is desirable. However, a northern exposure in the northern states is satisfactory as the light is clearer and whiter.

Other considerations are the topography of the site, the amount of available ground, and the amount of money available for gymnasium construction.

CHAPTER III

PLANNING THE GYMNASIUM FACILITIES

Number of Gymnasiums, Size and Height

In determining the number of gymnasiums and size of the playing floor, many factors must be considered, such as: number of students to be served during the day and the greatest number for any individual period, community use, community population trends and economic factors. In Engelhardt's volume, Standards for Junior High School Buildings, he quotes various authorities to indicate viewpoints on the number and size of gymnasiums:

California Score Card:

> Minimum sizes should be as follows: Boys enrollment of 100 to 500, gymnasium floor 50 feet wide, 85 feet long. Boys enrolled 500 to 900, a width of 90 feet and length of 90 feet. Sliding partitions not recommended.[4]

Jallade, American School and University, page 179:

> It is better to have two gymnasiums 60 by 80 feet rather than one 80 by 120, and it might be still better to have one 40 by 60 and another connected to this one 70 by 90.[5]

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[4] N. L. Engelhardt, Standards for Junior High School Buildings (Bureau of Publications, Teachers College, Columbia University, New York, 1932), p. 20.

[5] N. L. Engelhardt, loc. cit.

Keene, Physical Welfare of the School Child, p. 36:

> It should be the aim to provide one gymnasium for each 500 pupils enrolled in the school.[6]

Nash, The Administration of Physical Education, p. 213:

> From the standpoint of public school use, the problem is the number of gymnasiums for a large school rather than size.[7]

Strayer and Engelhardt, Standards for High School Buildings, p. 70:

> When enrollments in high school are planned above 800, separate gymnasiums for boys and girls should be provided. Two gymnasiums may be necessary in schools from 500 to 700, depending upon the kind of health program which is being advanced.[8]

From the foregoing quotations, it is readily seen that authorities favor two gymnasiums rather than one in the larger schools. However, in Oregon, with the many small schools, a single gymnasium with sliding or folding partitions is probably the most practical.

If partitions are used, they should be constructed of wood and be sound-proof. Motorized or electrically operated doors are most desirable, and when folded, should not obstruct the vision of the spectators and should not extend into the playing area.

One of the most difficult questions to be met by planners is the problem of size. How large should the

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6, 7 and 8. Ibid., p. 21.

floor be? There is no formula which will satisfactorily provide the answer. In arriving at a final decision as to size, a survey of the total situation, based on the following questions, should be undertaken: What is to be the nature of the program in which the pupils will engage? Will these activities require a large or small amount of space? What will be the total enrollment? How many periods per week will physical education be required of each student? How many teaching periods per day will be available? What will be the range of the size of the classes? What size crowds must be accommodated at basketball games? Will boys and girls use the same or separate gymnasiums?

The minimum standards for gymnasium size are quoted from specialists in the field. According to Strayer and Engelhardt[9],

> "The gymnasium room may have dimensions of 40 feet by 60 feet. A larger floor, 50 feet by 80 feet is preferred. The height of gymnasiums should be 18 feet under all beams and trestles."

The following chart from the California State Department of Education gives the minimum width, length

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[9] G. D. Strayer and N. L. Engelhardt, Standards For High School Buildings (Bureau of Publications, Teachers College, Columbia University, New York 1924), p. 73.

and height of gymnasiums according to the students enrolled.[10]

Enrolled	Width	Length	Height
0 to 150	46 feet	80 feet	18 feet
151 to 500	50 "	85 "	20 "
501 to 900	60 "	90 "	22 "
901 and over	70 "	100 "	22 "

Bleacher Space

Bleachers and bleacher space must be considered when planning the size of the floor. The size of the crowds that will attend the basketball games will provide the key to bleacher needs. The maximum turnout, rather than the average or minimum should be the guide. It is easier to handle a crowd below capacity than it is to try to expand immovable walls when facilities are inadequate. In general, bleachers can be classified under four types: (1) built-in or permanent, (2) temporary or portable, (3) folding, and (4) combination of these three. The choice of type and design of bleachers must take into account, in addition to the above points, the location of the drinking fountains, the height of the windows, the arrangement of basketball backboards supports, size of the court, radiators and doors.

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[10] Engelhardt, N. L., op. cit., p. 22.

The following standard can be used in determining the amount of seating needed and the additional floor space required for this purpose. Add 2 feet and four inches in width for each row of spectators, figuring 44 persons to each 66 feet of seating in length. Or, if folding bleachers, add allowance depending upon their dimensions when folded.

Lighting the Gymnasium

Lighting is another element of the gymnasium worthy of careful planning. Both artificial and natural sources must be considered. The amount of sunlight varies, but the average indicates that from 20 to 25 percent of the floor area should be window space.

There are several advantages in providing for natural sunlight. In the first place, it contributes to healthful school living. The radiant energy is essential to health. Perhaps the greatest value of light is based on the principle of more light for better seeing, which tends to facilitate faster reaction time to moving objects. Natural lighting also contributes to the cheerfulness and joy which should prevail in a play area.

Attention should be directed to hazards which may result from natural lighting if not properly planned. Careful planning will avoid the construction of windows

which permit glaring, interfering with the activity. Fast thrown balls are hard to see and the enjoyment of the activity diminishes under poor lighting conditions. It is advisable to place windows so that glare is minimized if frosted glass is not used. Diffusing glass which directs the rays away from the players eyes is recommended. The installation of heavy wire screening, to protect windows from breakage, reduces the amount of light transmitted. The use of wire-glass will provide the safety measure and at the same time permit greater transmission of sunlight.

Windows should be located on the two long sides of the gymnasium, but not on the end. Overhead lighting through skylights is the least desirable method of lighting.

Arthur R. Winters has this to say about windows in gymnasiums:

> Recently constructed gymnasiums reveal considerable use of glass-block windows. They not only let light in but are capable of diffusing the rays away from the eye level. These blocks are also impact resisting, a desirable characteristic in any gymnasium window. The greater initial cost of special glasses is offset by the savings in heat losses, by added safety, by improved lighting conditions, and by ease of maintenance.[11]

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[11] Arthur R. Winters, (American School Board Journal), p. 48, February 1946.

After the installation of windows there is still the problem of artificial lighting. It is estimated that the average time at school can be counted upon to provide sunshine only 26 percent of the time. Artificial lighting is needed to both supplement daylight and for night lighting. The planner's interest should center on the quantity and quality of artificial light, the direction of diffusion that will be provided and at the height needed. Insufficient artificial light not only makes poor playing conditions for the competitors, but reduces spectator comfort. Various lighting studies propose amounts from 10 to 50 foot-candles for gymnasium floors. The average being used appears to be about 15 foot-candles, which should serve as the minimum measure.

Since the direction at which the light is diffused is important, the location and arrangement of the lighting fixtures requires expert planning. The height, type of ceiling, type of reflector, amount of open space, are factors to consider. Not only should the baskets be well-lighted, but the fixtures should be so placed so their directed beam does not meet the eyes of the player on the floor.

It is well to check the fixtures for protection against glass breakage. Wire guards and safety glass are two safety measures used.

Walls

Interior wall finishes in gymnasium construction are of equal importance to the floor when planning the gymnasium. The following criteria are suggested in selecting material for the walls: (1) cost, (2) durability, (3) practicability, (4) insulating properties, (5) accoustical properties, (6) aesthetic qualities, (7) educational philosophy, (8) flexibility or adaptability.

Choice of materials will also be determined by whether or not the gymnasium is solely for gymnasium purposes or a combination gymnasium-auditorium. The discussion here assumes the material will be selected for use in the former.

Where walls are built with wainscoting, masonry materials capable of supporting apparatus or bleachers is recommended. Glazed brick or tile in light colors appear most popular because of their stability, attractiveness, smoothness and ease of cleaning. Plaster, cork and accoustical tile at this level do not offer a good surface for attaching equipment. Most recently constructed gymnasiums extend the wainscot above the bleachers or to the window sills. This height varies from 10 to 16 feet.

Above the wainscot, greater use may be made of accoustical and insulating materials. Lighter weight materials are more practical at the higher level,

resistance to stress or shock being offset by the saving in heat and reduction of noise. Cork blocks and thick accoustical tile blocks are recommended for sound-deadening finishes for the upper walls. Some authorities believe the entire wall to the ceiling should be of fire resistant material such as plaster, various types of bricks or tile. However, this is largely a matter of local opinion. Building codes should be thoroughly investigated before deciding definitely on the type of materials to be used. A desirable construction feature is to have the entire gymnasium building sound-proofed from the rest of the building.

The Gymnasium Ceiling

The ceiling is of low utility value and therefore but little attention will be devoted to it. Its style, pitch, shape, etc., will depend upon the location of the building and the type of building construction. There should, however, be a clearance height under the beams of 18 to 22 feet. The ceiling should be insulated similar to the walls regardless of its height.

Floors

The choice of materials and method of construction used in gymnasium floors show less deviation from what is

considered "best practice" than most any other element of gymnasium construction.

In a gymnasium floor the characteristics most desired are resiliency, smoothness, comfortableness, durability, ability to resist marking or scarring and ease of cleaning. Both materials and manner of construction contribute toward these qualities.

Many materials are on the market, mostly of recent origin for gymnasium floors. These are concrete, linoleum, asphalt tile, rubber tile and plastic tile, but because of their newness, care should be exercised in selecting this type flooring material. Birch, beech, oak and maple have all given good service, but the almost universal selection in recent years of hard-maple makes it a favorite floor material. Most authorities agree that hard-maple best fulfills the criteria listed above. A hard-maple floor of picked $1\frac{1}{2}$ inch tongue and groove of $\frac{1}{2}$ to 3/4 inch thickness is recommended.

The method of constructing maple gymnasium floors is more or less standardized. It consists of a reinforced concrete base upon which sleepers are laid 16 inches apart and are either fastened to or embedded in the concrete. On top of these sleepers, a hard pine sub-floor is laid at a diagonal. Then on top of this is laid tar paper, or felt, or some insulating material. Then the

selected grade of maple wood flooring is put in place.

It is suggested a seal and finish especially designed for gymnasium use, rather than floor finishes which are not suited to quick stopping, rubber burns, or marks. A reliable firm specializing in floor finishes should be consulted before making the final selection of material. It is advisable to discuss this important point with the contractor before he completes the job.

The Maple Flooring Manufacturers make these suggestions in preventing buckling, cracks and cupping:

1. Don't lay flooring immediately after delivery; allow absorbed moisture to evaporate.
2. Don't lay flooring until the building in which it is to be used is dry.
3. Don't lay flooring until plastering and cement work are thoroughly dried and woodwork and trim installed.
4. Don't lay flooring in cold, damp building. (70 degree temperature is recommended.)
5. Laying and finishing of hardwood floors should be the last operation in connection with the construction of the building.[12]

Departmental Offices

The efficient administration of the physical education department depends to a large extent upon the

[12] Arthur R. Winters, Planning the School Gymnasium (American School Board Journal), January 1946, p. 43.

location of the offices of the physical directors, both men and women, in relation to the rest of the rooms of the building. Many directors agree that offices should be situated between the gymnasium and locker room in such a manner that supervision is effective. This, however, does not appear to be the case with women instructors in physical education, many believing that the office should be located some distance from the dressing-rooms. Other locations of directors' offices, as indicated by Herbert Blair[13] are:

> "Under the bleachers, in the anteroom of the auditorium-stage, across the corridor, under the gymnasium, at the foot of the stairs leading to the locker room, and other places large enough for a desk."

Regardless of the varied opinions, certain standards should be considered concerning its location, such as, ease of accessibility to the gymnasium, dressing-rooms, athletic field and other rooms. A primary factor in location should be ease of administration and not a matter of where it can most conveniently be placed.

The physical director's office should have a minimum size of 8 feet by 10 feet. The office should be equipped with shower and toilet facilities and have

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[13] Herbert Blair, Physical Education Facilities for The Modern Junior and Senior High School (A. S. Barnes & Co. 1938), p. 14.

adequate heat, light and ventilation.

The Corrective Gymnasium

Recent trends in Physical Education are toward greater emphasis in corrective work. This trend has undoubtedly received impetus from the great number of physical rejections of men when called up for military service. An adequate corrective program is based upon facilities and equipment with which to work, as well as competent instructors, and, therefore, is an important phase in planning the new gymnasium.

The corrective physical education gymnasium should be located on the ground level, or second best, on the second floor, but never in the basement below the ground level. The long sides of the room should be exposed to the sunlight and direct ventilation. It is recommended that the room be located adjacent to the large gymnasium floor, the locker rooms and the departmental offices. If an examination room is planned, it should be located within close proximity to it.

The size of the room designated as the corrective room should be approximately 24 feet by 40 feet by 12 feet in height. This standard appears to be an average of the many recommended dimensions for high schools. The following factors should be considered in determining the

dimensions or the size of the floor area, as given by Gilbert F. Loebs:[14]

1. Scope of the required corrective program.
2. Size of the classes.
3. Number of periods required per week.
4. Scope of the optional corrective program.
5. Size of the present as well as the future enrollment.
6. Use of the room by both boys and girls.
7. Public usage of these facilities.
8. Amount of apparatus to be installed.

The same standards used in the construction of the main gymnasium floor apply to the corrective room, however, one authority says,

> "Where the corrective room is adjacent to the main floor, the floors should be continuous without a break or threshold, and if these rooms are separated by folding or sliding doors, they should then close off the entire space."

The structure and type of equipment to be installed in the corrective exercise room should be considered before the actual construction of the walls takes place, so that the necessary wall and ceiling appliances can be located or built into the walls. Impervious glazed brick is most desirable for the interior walls. The glazed brick should extend at least 10 feet above the floor level, and other material used above this level should be such as

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[14] Gilbert Fredrick Loebs, Planning and Equipping the Corrective Gymnasium (American School and University), p. 224, 1942.

to reduce noise and sound.

It is highly desirable that the corrective room receive as much natural sunlight as possible because of the germicidal power of sunlight. The window area should be at least 25 percent of the floor area. Windows should be 8 feet above the floor in order to utilize the wall surfaces under them for apparatus. They should be placed preferably along the sides of the gymnasium. However, if it becomes necessary to place windows in the ends, they should be equipped with the type of glass which diffuses the light and protects the students from glare.

Sufficient natural ventilation is highly desirable and of utmost importance in developing plans and specifications of the room. Natural ventilation, however, should be supplemented by some plan of fan system and exhaust, mechanically operated and automatically controlled. The objective of the heating system is to regulate the temperature, radiation, air movement and humidity so that optimum air conditions for health and comfort exist.

Natural lighting in the corrective room as well as the main gymnasium should be supplemented by sufficient artificial lighting. A diffused or indirect type of light is more desirable than direct lighting. The National Electrical Manufacturers Association recommends 15 foot-candles at the floor level as the minimum standard of

artificial illumination for the corrective gymnasium.[15]

The minimum equipment of the corrective room should be: balance beams, low and high plinths, stall bars, stools, mats 3 feet by 6 feet, mirrors 6 feet by 4 feet, horizontal ladders, and pulley weights. There should also be rings, flying and travelling, horses, parallel and vaulting bars.

Apparatus and Storage Room

Immediately adjoining the gymnasium and on the same floor level, preferably with double doors, there should be a room in which piano, mats, apparatus and miscellaneous other equipment can be stored. The room should have a minimum size of 15 feet by 25 feet and is desirable to have outside windows to maintain adequate ventilation, especially for mats and other soiled equipment. If portable bleachers are to be stored, it is desirable to have another room for this purpose, otherwise sufficient space will not be available.

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[15] Gilbert Fredrick Loebs, Planning and Equipping the Corrective Gymnasium (American School and University) p. 225, 1942.

CHAPTER IV

SERVICE FACILITIES

Locker Rooms

Inadequate space and service facilities for physical education in our schools is quite common. This has been due to the expanded program in physical education, lack of funds, and probably for lack of information and planning. It is both desirable and necessary that ample provisions and plans be made for locker rooms in gymnasium construction.

Both locker and shower facilities should be located so as to provide ready and direct communication to and from them and to gymnasium, pool, playfields and classrooms. Proper placement or arrangement of such space provisions should be given to this point to eliminate cross-traffic, reduce pupil travel to a minimum, avoid points of congestion, promote hygienic conditions, and simplify the administration and supervision of service facilities.

The following chart[16] indicates the placement of

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[16] Herbert Blair, Physical Education Facilities for the Modern Junior and Senior High School (A. S. Barnes & Co. 1938) p. 32.

the locker room in relation to gymnasium from a survey conducted in Massachusetts, New York, Pennsylvania and New Jersey:

	Mass.	N. Y.	N. J.	Pa.	All
Adjacent to Gymnasium	9	18	15	15	57
Under Gymnasium	7	9	3	9	28
Under Bleachers	1	2	0	6	9
Across Corridor	1	5	2	5	13

This chart clearly indicates that the majority of locker rooms are located adjacent to the gymnasium.

Recommended space to be used for dressing purposes, provide for 12 square feet per pupil for the largest number dressing in any one class period, exclusive of lockers. In addition, the following factors might be considered. The width should not be over twice the distance from the window top to the floor. A room which is longer than it is wide is generally more satisfactory as it allows better arrangement for lockers.

Adequate provision should be made for lighting, heat, ventilation and safety features. It is especially important that sunlight be admitted. To accomplish this, the installation of skylights is desirable. Another consideration is the ratio of window space to floor space, the standard being at the present time, about one-fifth for rooms not over twenty feet in width.

In providing for benches, the following considerations are important. Benches should be fastened securely

to the floor and provide not less than 12 and preferably 18 inches of seating space for each pupil in the peak load. They should be placed not less than 18 inches from the lockers to insure adequate dressing space. Aisles between the benches or rows of lockers should be at least 6 feet wide.

Lockers

Physical education has always been seriously handicapped by the lack of adequate dressing-room facilities. Most locker systems have been wasteful of space, poorly organized and unhygienic. Wm. R. LaPorte, Professor of Physical Education, University of Southern California, lists the following factors in developing an efficient locker system: (1) safety from theft; (2) ease of access; (3) sanitary storage; (4) close supervision; (5) facilities for frequent exchange of equipment and laundry; (6) ventilation; (7) use of minimum amount of floor space; (8) elimination of counter attendants during class hours if desired; (9) elimination of waiting and standing in line; (10) reasonable cost[17].

[17] Wm. R. LaPorte, University of Southern California Basket Locker System (American School and University) p. 182, 1933-34.

Locker and dressing provisions may consist of any one of several types, a brief explanation of the more common types to be discussed here. Where the individual type locker is used, each pupil is assigned a full-length or half-length locker equipped with a lock, a combination lock being preferable over the key type of lock. The individual type locker is suggested only for the smaller schools and is not adaptable where large numbers of students are to be served. In the combination, common and box lockers, each pupil is assigned a box or gym-suit locker. For each five to seven box lockers, a larger or full-length locker is provided in which five to seven pupils keep their street clothes during physical education periods throughout the day. Padlocks may be used on the lockers containing their street clothes during class periods. The basket system is probably the most popular in new gymnasiums. Under this system, each student is provided with an individual basket for gymnasium apparel. Baskets may be kept in a special basket locker room, from where they may be issued through a window, or they may be housed in metal racks which can be wheeled to and from a basket locker storage room. Under this plan, only the basket lockers for a given class are accessible to pupils during a given class period. This plan is particularly good for the large schools.

I, O. Friswold, Director, Buildings and Business Administration, Minnesota State Department of Education, makes the following suggestions for the installation of lockers:

> Fixed lockers should be arranged with due regard to windows to assure the most effective natural illumination that can be secured.
>
> Lockers large enough to accommodate street clothes properly should not be less than one foot by one foot by thirty inches in size.
>
> If double-tier lockers are installed, a sufficient number should be provided so that only one of each two lockers would be used during a given class period.
>
> Fixed lockers without legs should rest on raised platforms about 4 inches high. In any case, lockers should be designed to permit ready cleaning of the floor and prevent accumulation of dust and refuse under them.[18]

Heating and Ventilation

The primary objective of ventilation is to provide comfort for the individual. Comfort and quality of the air are determined by four factors; namely, temperature, radiation, air movement and humidity. The desired results may be obtained by modifying any one or more of these factors.

In a properly heated and ventilated room, a suitable degree of warmth should be maintained. The air at

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[18] L. O. Friswold, Planning Locker and Shower Facilities For Physical Education (American School and University, 1941), p. 263.

head level should not be appreciably warmer than near the floor, the air should be moving rather than still, and be free from odors. The amount of air per pupil and the velocity of air movement should be great enough to reduce odors and maintain the desired temperature without causing discomfort from drafts.

In the shower, locker and dressing-rooms, the problem is excess moisture, which results in lack of evaporation from the body and from clothing stored in the lockers and baskets. Because of this humidity factor, it is important not only to have a constant change of air through the rooms, but to arrange lockers and baskets in a manner which will allow free circulation of air.

The system of heating the locker, dressing, shower and toilet rooms is dependent upon the system of heating employed throughout the whole building. These systems will, in general, be included under one of these three main headings: (1) window-gravity type, (2) unit system, (3) plenum system.

The window-gravity is probably found most commonly in school buildings. The heat is imparted directly to the room by means of radiated surfaces within the room itself. For successful use of this system, the following points should be considered:

1. Radiators should extend the full width of the windows from which the air supply is to be derived.

2. Radiators should be equipped with control devices, either automatic thermostat, hand control, or both.

3. Radiators should be well-protected or placed high on the wall to prevent burning.

4. Deflecting boards should be placed at the bottom of the window. Windows open from the bottom.

5. Windows should not be curtained.

6. Exhaust ducts having a total area of not less than 4 square feet should be provided on the wall opposite the windows.

The plenum system is an indirect type of heating in which the radiating surface producing the heat is not situated in the room to be heated, but is conducted to rooms from its source by ducts. This system usually filters suspended matter from the air, often washing it with steam and water. This type of heating provides the most even flow of air into the room and is automatically controlled at the heating source. It has an added advantage of removing foul air. It is more expensive, however, to install than a window-gravity type and has the disadvantage of utilizing considerable space for ducts.

The unit type of heating employs a system by which air is sucked in from outside through deflecting veins by a fan which mixes the air thoroughly and blows it through

the coils of a radiator placed in or near the outside wall. This method provides for thorough mixing of air and thus prevents wide variations of temperature between floor and ceiling. It is very compact and well-protected, which shields the pupil from direct heat or burning.

The choice of systems will depend on the local conditions and cost. Whichever type is used, it should heat the dressing and shower rooms to an even temperature of 75 degrees F. and toilet rooms to 68 degrees F. The system employed should adequately remove the foul air from these rooms.

Shower Rooms

Particular attention must be paid to the design and equipment of shower rooms, together with their location in relation to other facilities. With increased emphasis on physical education facilities, it is necessary that shower rooms be adequately planned, giving consideration to the number of pupils in the largest class, whether the gang or individual cubicles are to be used, and the length of time that is allotted for bathing and dressing.

Shower rooms should be located close to the locker room, lavatories and gymnasium. The trend is toward the construction of a drying room between the locker and shower rooms. The footbath should be placed at the

entrance to the shower room and be of sufficient length to require two or three steps in the bath and of at least 3 inches depth. This provision is one way of preventing "athletes foot", in addition to general sanitation and cleanliness.

There are various standards for the size of shower rooms, but the average seems to be between 14 and 18 square feet of floor area for each shower head. However, this will depend upon the total enrollment and size of the largest classes.

At present, the trend is toward a long narrow room, wide enough so that showers can be placed on both walls with the drain near the walls. This plan is especially adaptable to the "gang" method of shower room control, as it is possible for the attendant to control all showers, starting with warm water and finishing with medium or cold. By this method, about two minutes are consumed for the shower. The "gang" method of control permits the average size class to take a shower in six minutes, figuring one-third of the group every two minutes. It is advisable to have some of the shower heads controlled individually so that they can be used after school. The "gang" method has these advantages: The instructor may ascertain whether each student actually takes a shower; the duration and proper

temperature can be accurately controlled to prevent waste of water as well as waste of time.

Another method of shower room control which permits the continuous flow of students through the shower room, provides that the first three showers be set for warm water, the fourth with water of medium temperature and the fifth, cooler water.

Jay B. Nash, in discussing boys' and girls' showers has this to say:

> Boys' showers are usually arranged in batteries without partitions and with individual control. Great care should be taken to have large outlets so that the water will not back up. The spray should strike at shoulder height and the heads should be firm. Liquid soap should be supplied from built-in fixtures. All pipes should be concealed, but in easy access for repairs.
>
> Girls' showers. It has been held in the past that girls demand individual showers either next to their dressing booths or in a special shower room. These are expensive from the standpoint of cost and space. There is a growing feeling that closed shower booths are not necessary and there is considerable evidence that girls prefer open showers and choose to dress in front of their lockers. Shower heads should be so placed to strike the bather at shoulder height. In light of the present trend, it would seem advisable to have 20 percent of the showers of the booth type and 80 percent open.[19]

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[19] Herbert Blair, op. cit., p. 34.

Attention should also be given to the materials used in the shower room. Floors should be impervious and have a non-skid surface. In rectangular shower rooms, drainage may best be accomplished by sloping toward each wall with a long narrow slotted drain next to the wall. This eliminates the necessity for bathers walking through the water as it runs into the center of the room. Roughly finished cement has been commonly used for shower room floors, and by using properly selected paint, fairly good sanitation can be maintained. Other materials used for shower room floors are tile, mosaic, or terrazzo.

The walls should be constructed of glazed tile. It is recommended that the tile extend to the ceiling. The collection of moisture on the ceiling can be minimized by sloping it. Plaster should be avoided in shower rooms if possible, but if it is used, should be thoroughly waterproofed.

The shower heads should be of the goose-necked type with an adjustable shower head. In girls' showers, the shower heads should not be more than five feet above the floor level. Most commonly used shower heads at present are ones with slotted holes which are non-clogging. The intensity of the flow of water can be easily adjusted and they are easily cleaned.

There are other factors that need to be considered

in planning and constructing shower rooms, but the above discussion gives an insight into some of the problems.

Sanitary Features

Toilet facilities should be placed in a separate room but should be close to both the shower and dressing-rooms. It is preferable that the shower and dressing-rooms are provided with an opening to the toilet room. In general, the location of the shower, toilet and dressing-rooms should be planned to require a minimum of opposition to a smooth, easy flow of traffic.

A sufficient number of water closets, urinals and washbowls as may be needed to care adequately for the needs of the number of pupils in the largest class should be installed. There appears to be varied opinions as to the number of these facilities to provide, but the following standard seems acceptable: One seat to every twenty girls; one seat to thirty boys; and one urinal to every twenty boys. One lavatory should be provided for every two seats for girls and one lavatory for four seats and urinals for the boys.

Walls, ceilings, floors and partitions of toilet rooms should be of impervious washable material. Terrazzo, marble or cement floors are satisfactory.

Entrance of direct sunlight is an important matter

in ventilation of the toilet room. Windows should be provided to furnish both ventilation and direct sunlight. If windows must be kept closed, then an individual forced ventilation system should be used which is not connected with the central ventilation system of the main gymnasium. Ventilation of the toilet room consists primarily of the removal of the air from the room. To accomplish this, individual exhaust fans, not connected to central system are necessary.

Team Rooms

For the home athletic team, it is practical and more economical to provide lockers and the necessary storage space in the regular physical education dressing-room. By placing a row of full-length lockers 12 inches by 12 inches by 72 inches and arranging for sufficient dressing space, the athletic teams can be provided for.

It is recommended that provisions be made for first-aid or a training room to care for the needs of the athletic teams and physical education classes. The extent and size of this room will depend upon the needs and desires of the local school.

For the visiting team, an extra dressing-room is desirable. This room should be planned so that it can be used as a supplementary room for school or community

groups. The size of the room will depend upon the extent of its use. If greater use is planned than just for visiting teams, a floor area of 12 square feet per pupil is recommended. However, if only limited use is anticipated, a smaller floor area may be planned. The room should be provided with toilet and shower facilities, although some schools have arranged these facilities so that both teams use the same shower. This decision is left to the local school administrator. Adequate heat, light and ventilation should be provided. Sufficient lockers need to be provided to care for a minimum of thirty-five men who might be dressing for athletic participation. Provisions should be made for locking the doors of the visiting team room to safeguard their possessions.

Drying Room for Athletic Clothing

It is advisable to provide space for drying athletic equipment from the standpoint of sanitation, hygienic conditions and economy. This is especially true in the larger schools where greater numbers of athletic uniforms are in use. This room should be located next to the main locker room and large enough to hold drying racks for a day's allotment of clothing for football. Again, the size of the room will depend upon the number of uniforms to be cared for and general local conditions.

Common Mistakes in Planning the Gymnasium

It is interesting and of value to note common mistakes made in planning the gymnasium building. These have hampered both teachers and pupils. The following points might well be given consideration by the school administrator when making plans for a new gymnasium. They are listed by W. K. Streit in the American School Board Journal.

1. Playing courts, especially basketball, not large enough.
2. Inadequate shower and dressing-room space.
3. Inadequate drying room or none at all.
4. Poor lighting, ventilation, insulation.
5. Lack of unit planning.
6. Too many small rooms.
7. Not enough storage space for equipment and often not accessible.
8. Lack of natural lighting (southern exposure).
9. Inadequate provision for girls' facilities.
10. Ceilings too low for basketball and volleyball.
11. Too little space for spectators.
12. Giving architect full authority to plan and execute in a field in which he may not even be remotely interested or informed.
13. Doors into storage and apparatus rooms too narrow.

14. Lack of laundry facilities.

15. Lack of team rooms, check rooms, and toilet facilities.

16. Not planned for uses to which they are actually to be put. Completed plans should not be set up by an architect until instructors who are to use them have been consulted and permitted to outline the necessary purposes and uses.

17. Floor plans are not set up in advance for various activities. Safety factors overlooked.

18. Putting lockers and showers in dark, poorly ventilated places.

19. Failure to provide office, showers and dressing space for instructors.

20. Failure to include pipes for suspended apparatus.[20]

[20] W. K. Streit, Planning Facilities for Health, Physical Education and Recreation (American School Board Journal) p. 51, September 1945.

CHAPTER V

SAFETY FEATURES IN THE GYMNASIUM

In planning for safety, we must realize children are the greatest resource of the nation. The toll of accidents has made people conscious that life, safety and health of school children should be of first consideration. Yet, only recently, a nationally known safety organization after an extensive survey stated that the majority of our schools are unsafe.

The survey indicated that corridors, stairways, classrooms and auditoriums contributed 35 percent of the school building hazards. Gymnasiums, pools and locker rooms are responsible for 41 percent of building accidents. Thus, the school administrator should be conscious of this fact when planning the new gymnasium.

The first step in planning the gymnasium for safety is fire resistant construction, to the extent it is economically possible. The building code recommended by the National Board of Fire Underwriters will give valuable information relative to fire resistive construction. It is also suggested city and state building codes be consulted as well as the State Department of Education. Of prime importance in reducing the number of fires is the choice of architect to design the gymnasium. The following

suggestions are offered in protection against fire hazards.

Automatic controls on heating devices against overloads, explosion, and fire are recommended. All stairways should be constructed of concrete and terrazzo, and fully enclosed underneath to prevent the storing and collecting of combustible materials. Fire extinguishers and fire hose should be installed and accessible within 100 feet of any place in the building and recessed in the corridor walls and each end of the gymnasium. Fire-alarm signals separate from the regular signaling system can be sounded at stations spaced 100 feet apart throughout the gymnasium and connected with the main building.

Safety devices, such as lock-down panic bolts, hold-open arms, and long door pulls, should be provided on all exit doors. Corridor floors, steps, shower room floors, should be of non-slip material, preferably terrazzo.

Every effort should be made in constructing the gymnasium to avoid projections and other possibilities of injury. Windows should be fully screened with swinging screens opened from the inside. Lights in the ceiling should be recessed and all glass doors made of safety glass. Drinking fountains, cuspidors should be recessed flush with the wall.

Benches in the dressing-room should be securely

fastened to the floor to avoid accidents from upsetting or blocking normal paths of travel. It is recommended that lockers be bolted or secured to the cement to avoid overturning. It is also advisable that showers be thermostatically controlled to avoid scalding.

In planning the gymnasium, provisions should be made to handle peak loads to prevent overcrowding and pushing. It is desirable that the instructors' offices have a clear vision of the total area, both gymnasium and locker and shower room for proper supervision.

In a survey of physical education instructors, conducted by Frank S. Lloyd, the following items presenting the greatest hazard situation or causes of accidents in gymnasiums are listed:

1. Slippery gym floor.
2. Slippery shower floor.
3. Steps or stairs.
4. Overcrowding of equipment.
5. Overcrowding of floor space.
6. Equipment in poor repair.
7. Inadequately erected equipment.
8. Drinking fountains.
9. Swinging doors.
10. Wall obstruction in playing space.
11. Poor construction which obstructs instructor's vision.
12. Pillars or posts in playing space.
13. Carelessness of students.[21]

[21] Frank S. Lloyd, Safety in Physical Education in Secondary Schools (National Bureau of Casualty and Surety Underwriters, New York, 1933), p. 96.

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