

DESIGNING FOR PRIVACY IN THE LEARNING ENVIRONMENT

by

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By Philip G. Pipal

Submitted to the Department of Architecture on February 12, 1980, in Partial Fulfillment of the Requirements for the Degree of Master of Architecture.

Abstract

This thesis looks at the need for privacy in the general instructional areas of an elementary school, with the role of the architect in mind. Taking off from the open-plan school, the most recent trend in educational architecture, a case is made for building a range of private places in the school environment.

A review of the literature provides a look at behavioral and environmental research on privacy, as well as background information on educational and school design issues. An investigation of a handful of schools in the Boston area gives a description of how the class spaces are used, and uncovers shortcomings and strengths of the buildings. Finally, this information is used to draw some conclusions about how the physical form can provide the necessary privacy. These conclusions are interpreted into design ideas.

In focusing on the issue of privacy, several other peripheral issues such as flexibility and educational philosophy are dealt with. Enclosure and access, issues that bear directly on privacy are discussed.

It is concluded that more enclosure than has been provided in open-plan schools is needed on the grounds that more enclosure supports rather than inhibits the activities taking place in a school.

*Thesis Supervisor: Sandra C. Howell, PhD.
Title: Associate Professor of Behavioral Science.*

To the teachers.

Thankyou Nancy Angney, Victor Atkins, Roland Barth, CAPS Teachers, Cashman Teachers, Lawrence Cheng, Devotion Teachers, Fayerweather School, Kris Fields, Al Fortune, John Freeman, Steve Friedlaender, John Graham, Helen Herzog, Sandra Howell, Steven Imrich, Jerry Kaplan Robert Kramer, Lawrence Teachers, Tunney Lee, Peggy Newman, Henry Olds, Pierce Teachers, Tom Pfau, Frank Pipal, Maxwell Pounder, Nathan Purpel, Laurie Putscher, Quincy School, John Roche, David Sheffield Robert Sperber, Wayne Welke, Cynthia Wolfe and many others.

INTRODUCTION

As an architect, I see the need to incorporate behavioral information in the design process; and I realize that that information must be more than intuitive. Increasingly, sophisticated architects are relying on design information generated by others. This includes behavioral scientists, who have the necessary expertise for gathering and evaluating data the architect needs, but cannot generate for himself. Turning that information into a product the architect can use requires some collaboration between the two professions. This translation of information that is one of the major problems at the interface of the two fields today. This thesis is in part an attempt to come to a better understanding of the process of investigating a building type in use, and systematically drawing some conclusions about the needs of the user-client. In conjunction with information gathered from the literature, these conclusions are used to develop an attitude towards the design of a similar environment.

PURPOSE

" For architects interested in pursuing such fundamental questions as 'How do we build better schools?', the mainstream of educational research literature appears largely irrelevant."
(Angus/Evans)

I chose the elementary school for my study for several reasons. In a previous project, an investigation of the use of space in three elementary grade classes at the Pierce School in Brookline, I became familiar with this type of setting. These classes had very different amounts of architectural enclosure, and three different teachers. The study helped point out the complexity of both architectural and behavioral issues involved and the difficulty of separating the former from the latter. At the same time, it inspired this thesis by suggesting that one issue, PRIVACY, may be central to the problem of designing an effective new learning environment.

A school building typically has many clients: students, parents, teachers, administration, and school board building committees, each of whom have different goals and attitudes about what the building should be. The group with the most power in the design decision-making process, the school board building committee that pays for and commissions the building, is least involved in the use of it. Conversely, the students and teachers have least power, and use the school the most. This is one of the clearer examples of the disenfranchised user-client, whose needs have to be strongly advocated. ⁽⁸¹⁾

The responsibility for this sits squarely on the archi-

tects' shoulders. For this reason, this inquiry will be worthwhile if it is able to increase the amount of user-pertinent design information available to architects.

While elementary school construction is presently declining in this area of the country, it is by no means a dead issue. Many southern and western states continue to build schools, and European nations have educational philosophies similar to ours.⁽⁶⁴⁾ Along with renovations and maintenance of the existing school building stock, there is still a large "population" to which the ideas presented here may be pertinent.

Most importantly, the "open-plan" school from which this thesis begins, is a relatively new concept, used in this country for fifteen years. Consequently, there has not been a great deal of evaluation of these kinds of spaces from an architectural point of view. There have been several educational and sociological evaluations, but few attempts have been made to give architects hard information on where elementary school design might go in the aftermath of the implementation of this concept. This effort takes a preliminary look at an emerging attitude about how a learning environment should be designed.

"The lack of evaluation is the most devastating criticism that can be made against current design practice." (Bechtel)

POINT OF VIEW

I have made certain assumptions in writing this thesis, and of course my attitudes and biases could not be separated from it completely. I have attempted to take educational philosophies as a "given," knowing that I am not equipped to evaluate them and acknowledging that they are numerous. General needs emerge however, from which I think it is possible to make some definitive design conclusions.

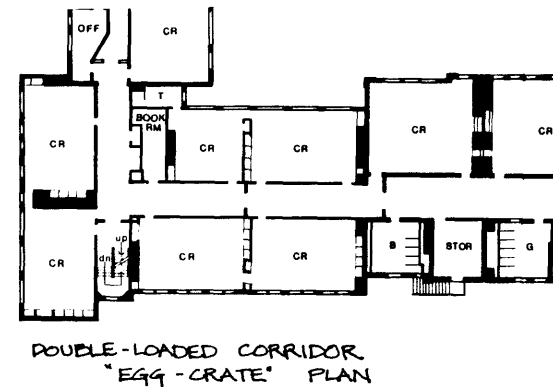
My own bias is for a "progressive" philosophy of education, a method that is individualized and exploratory. Yet simply by assuming that there have to be school buildings, I am taking a politically conventional stand that precludes a less structured view of the socialization process of children. It is a pragmatic approach; assuming that school buildings will be around for a while, I want to make them as suitable as possible.

"The physical environment should maximize the freedom of its users to choose the way they want to live." (Zeisel)

My design philosophy makes me think that school design in the past has focused on solutions that are too coarse in enclosing learning environments. If we look more closely at the generic implications of human behavior to inform designs, I think the idea that "all environments for human habitation require a range of privacies," is borne out. At the outset, I was in favor of open-plan schools. I made the mistake many have made in associating this architectural solution with progressive educa-

tional philosophy. I have tried to explain the distinction and enumerate the advantages and disadvantages of this building type. I do not see insurmountable problems in some openness that would suggest a need to return to enclosed classrooms in an "egg-crate plan." Yet problems are severe enough to warrant something radically different from the open plan as currently interpreted.

I have focused on trying to understand the activities that go on in a school. In these activities certain patterns of movement and typical groupings can be seen. Whether it is reading, writing or art work, there are certain needs that inform the design of a supportive environment for the task. Some of these needs, such as enclosure, relate to the ability to find adequate privacy. I consider privacy to be a prerequisite for accomplishing some of the important tasks in an elementary school program, no matter what size group the tasks are done in. To find out about the class activities and the need for privacy, I visited schools. I watched schools in operation and mapped the location of furniture, assuming that these layouts give clues as to how the space is used. I also talked to many of the people involved in making and using the schools; administrators, architects and students. My primary source of information are the teachers, who direct the use of the space at the



level that concerns this thesis, i.e. the class area. Their comments are included here. The teachers understand the students and their interaction with the physical environment best of all. Of course, the class areas are also built for them. If it does not suit their teaching method, the architect cannot suggest that their method should change. The building must make the effort to support all the teachers' styles.

" The facade and walls of a house, church or palace, no matter how beautiful they may be, are only the container - the box... Architecture is environment, the stage on which our lives unfold." (Zevi)

EDUCATION AND PRIVACY

At the outset it should be emphatically noted that "open education" and "open-space" are two very different things. But in order to understand how open-plan schools came about, and how to design elementary schools today, "open" methods of teaching that have had a lasting effect must be understood. "Open education" is a teaching philosophy with modern roots in the works of Maria Montessori, John Dewey and Jean Piaget. It's history in modern practice started in Post World War II England, and developed slowly through the nineteen-fifties. Blackie⁽⁹⁾ points out that the new relationship children and teachers found themselves in during the evacuation of British cities during the war was the catalyst. The teacher was responsible for all the children's needs, not just academic ones, and for their total development. At the same time learning was in make-shift surroundings where improvisation had to be the rule. This experience, with the philosophical underpinnings of Piaget et al. led to experimentation in country schools (notably Leicestershire).

OPEN EDUCATION

see "Crisis in the Classroom"
by Charles Silberman.

In the United States in the nineteen-sixties, there was a growing dissatisfaction with the results of conventional teaching methods. American educators like Roland Barth,⁽⁶⁾ saw these English models of open education in practice and reported back here with a solution to our "crisis in the classroom."

One purpose of an "open educational" philosophy is to make the learning experience more personal in the hopes that ideas will be understood better and retained longer.

"...increasingly difficult to require that a diverse student population conform to a standardized educational process." (L.R.D.C.)

It caters more closely to the unique needs of the individual student, and to that end, more of the responsibility of the education is put into the individual's own hands. Consequently, students deal with educational materials at their own pace, and work with them directly. The emphasis on what is learned shifts, as well as with how it is learned. The focus is now on understanding concepts that materials from many different disciplines.

The other purpose of this philosophy is to address the socializing aspects of schooling, because "whether specified or not, the outcomes of schooling are social as well as intellectual."⁽⁴⁹⁾ Interactions between individuals and groups are many and varied, partly because the class is no longer doing the same thing at the same time. Students rely on themselves and their peers as well as

upon the teacher. Social skills are developed to a more sophisticated level.

Several innovations in methods have been implemented to achieve the goals of open education: the open classroom, team teaching, non-graded schools, and a variety of attitudes towards how students should be grouped together.⁽⁴⁹⁾ These are all characterized by their attempt to optimize resources (including teachers) to fit with the students' needs.

These methods have had mixed reviews. There have been many evaluations showing a variety of results and generating much controversy. In 1976, Martin and Pavan⁽⁵⁴⁾ reviewed much of the literature evaluating these methods and concluded that they "...have not detrimentally affected cognitive or affective outcomes. Properly implemented, they are valid alternatives to the traditional mode." Similarly, the whole notion of open education has received lukewarm responses, but more recent research is increasingly positive. Affective attributes were often seen to benefit from open education,^(36,69) but for many, the important question is whether students made gains in cognitive skills. More often than not, researchers discovered students were worse off academically. Proponents however, disagreed with the evaluating techniques employed.⁽³⁹⁾ Lately

" We are mutually interdependent never more than we are now - nowhere more than in America - this is something which has to reflect in the classroom." (Morrison)

though, open education has shown positive results in this area too, according to research reviewed by Bader and Blackmon.⁽⁵⁾

Whether or not these educational innovations can be found in their ideal form, their impact on today's public elementary school has been profound and permanent. Of course a whole range of teaching styles can be observed in all schools, from individualized open programs to those that are teacher-directed and relatively conventional. But classes with desks bolted to the floors facing a blackboard are extinct. Despite the fact that a return to conventional teaching practice has received impetus from some of the failures of new methods, it appears that the trend towards "open" education will continue.

BEHAVIORAL IMPLICATIONS

It would seem that there are three basic behavioral implications of the open education philosophy that concern designers, no matter what particular method is used. Many activities occur simultaneously, groupings of students vary, and people are in constant flux. This is in sharp contrast to traditional classrooms in which a single activity was performed by the group as a whole riveted in one spot. Now, there may be many activities, as a result of personalizing the education. Individual

students spend as much time as necessary on the certain skills they need to master. Since the emphasis is on letting the child have hands-on access to the materials, which may be limited, not everyone can work on the same thing at one time. So to maximize use of resources, and to fulfill each students learning needs better than might be the case in a class group situation, different activities go on at once. Many of these tasks are best accomplished individually, others in small groups with or without the teacher. And in fact, some tasks are best performed as a class group or larger, so that any number of sizes of groups may occur. The intent is always the same: to optimize the use of the students time and the resources the school offers while providing a more individualized education. Thus the teacher also shares time with individuals or groups, depending on the need. Thirdly, since an abundance of educational materials are needed to conduct these activities, there will be a lot of movement between where the resources are and where the work is being done.

Because of the confusion between teaching method and space planning concepts, centering around the use of the word "open," it is important to clarify which behavioral and design implications are a result of which concept. Similarly, associated problems must be sorted out and compared to problems of conventional ideas.

" The principal point of the open classroom is, of course, that the ideal of the unison of the class is essentially broken. In its place the class is considered as a set of individuals and small groups, self-paced in their instruction." (Morrison)

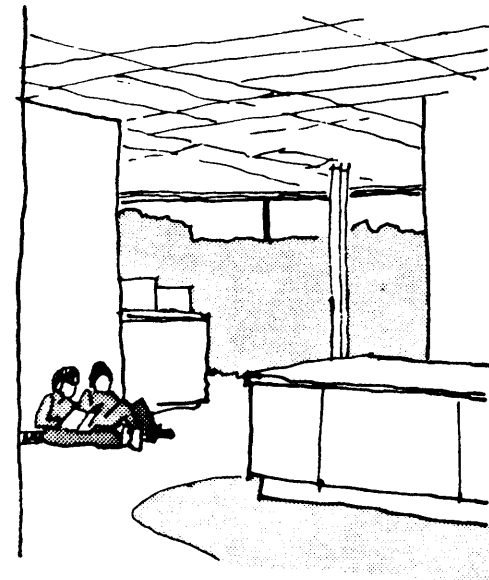
Open educational programs can and do exist in conventional physically enclosed rooms. As such however, the classroom bears little resemblance to that of twenty years ago. Desks used to be lined up in rows facing the teacher's desk which dominated the room in front of the blackboard. Such a singular use of space reflected, and was completely adequate for, a similarly singular mode of instruction. As noted, open education implies that the various students in one classroom are involved in different activities at any one time and so one sees many subject/activity areas located around these classrooms. Individual sub-settings within the room reflect the fact that groups of various sizes use different spaces: an area large enough for the whole class to sit on the floor together, nooks for small groups, etc. The content of the subject matter of various activity areas may be evident: a corner requires comfort for quiet reading, so it is carpeted, but where potentially messy work is done, there is a sink and easy to clean surfaces. Since resources, including the teacher, are found in different parts of the room, there is always some movement going on around the room. A range of sub-settings with pathways through and around need to be defined. Various pieces of furniture are employed to do this in addition to the desk and tables. Many of these are

storage pieces, since a great deal of educational material is typically needed close at hand in open educational settings. These conditions exist in elementary school classes today where a more open educational philosophy is used, regardless of whether the space is open or walled in. In describing the same style in open space one would talk of the same attributes, but simply substitute the word 'area' for 'room'.

That children search out privacy in the environment, including the open-plan school, is well documented. When asked, children I spoke with all had places in the classroom to which they would retreat to "be alone." Teachers verify this and talked of children finding privacy in unthought of places, indicating that even if the environment doesn't aid the search for privacy the desire is strong enough for the kids to make do. Researchers have seen students using closets, stairwells and places under tables for study. (22,35, Rothenberg quoted in 41)

Wolfe and Proshansky⁽⁷⁷⁾ point out the importance of privacy at a group level, in order for it to accomplish what it sets out to do. As with the individual, a constant need to respond to outside intrusions reduces the group's effectiveness. Also, the group must be able to "exercise some freedom of choice" as to how

PRIVACY



STUDENTS FIND PRIVACY OUTSIDE OF CLASS AREA AT CASHMAN

private it is. If it wants to interact with other groups it should be able to do so.

*"... only through the restored opportunity for firsthand experience that privacy gives can health and sanity be brought back to the world of mass culture."
(Chermayeff/Alexander)*

" If the group is everywhere, there is no group because there is no individual." (Woods)

The reason the individual needs some privacy in an environment such as the school, which is made up of groups, is that the ability of an individual to function well in a group activity is dependent on his own sense-of-self. Accordingly, architects acknowledge that in order to deal with the demands of the community, the individual must have adequate privacy.⁽¹²⁾ The group benefits from the ability of each individual to separate from it. "If individuals have to learn how to function in groups, to be aware of the importance of group goals, the needs of others and to separate these from their own non-group or egocentric interests, then the group must in turn learn to recognize the need for autonomy and more specifically for privacy in each of its members. To function as an effective group member, the individual must first be able to function in his own right. This means that the group setting must provide conditions that facilitate the latter in order to guarantee the former."⁽⁷⁷⁾ This process of separation is very important in the development of the child.⁽⁴²⁾

Child development is described as a process of the child differentiating himself from his environment (other

people, etc.). At this elementary school age development of social skills, interacting with peers in groups or individually begins. Children are constantly in the process of testing out relationships with others. They need time and space in which to contemplate and practice their interactions with others. And they learn how to understand environmental clues regarding others' desires for privacy and begin to put their own into use.

The open plan has lost support (or never had it) from many teachers who dislike being exposed when teaching. Jacobs⁽⁴²⁾ suggests that some may feel threatened by being on view to their peers, supervisors and a larger student body. Failures of their programs and disciplinary problems are more evident. Even if they feel relatively secure, many teachers complain of the amount of energy demanded by dealing with an open program and the fact that open space offers no relief. The teacher needs to be able to get out of the mainstream also; to retreat with a group or an individual and work away from distractions.

The best definition of privacy comes from Altman⁽³⁾, who describes it as a two-way process, not just one of closing out others. It is a matter of controlling the level of interaction. When the individual loses the



*" There is no space provided for teachers who need to be alone for a few minutes. I consider this a serious oversight. If I could press a button and make four walls appear around my class meeting area, so that we could sing, shout, or sit in silence for five minutes, I would be delighted."
(Cashman School teacher)*

"...privacy mechanisms define the limits and boundaries of the self. When the permeability of those boundaries is under the control of a person, a sense of individual develops. But it is not the inclusion or exclusion of others that is vital to self-definition; it is the ability to regulate contact when desired." (Altman)

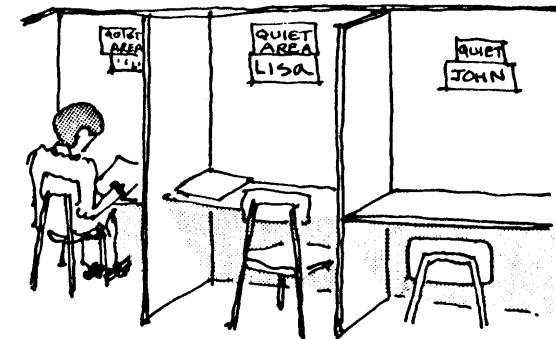
ability to regulate, the sense of isolation or overcrowding may result. People control interaction by a number of means, one of which, use of the built environment, concerns us here. Either we manipulate the surroundings in some way, or we change our own position relative to the environment in order to achieve the desired level of privacy. Either we move a screen, or sit at a study counsel to screen out intrusions. To increase interaction we might open a door or turn to face a neighbor. It follows that the more ways one has to get to that certain level of privacy, the more likely he is to achieve it, and the more satisfied he will be. Therefore within reasonable limits, the more spatial variety in an environment and the more pieces one can manipulate to change it, the greater should be the opportunities.

ENCLOSURE

" Disruptive behaviors also occur because of the inadequate or improper physical separation of activities." (Olds)

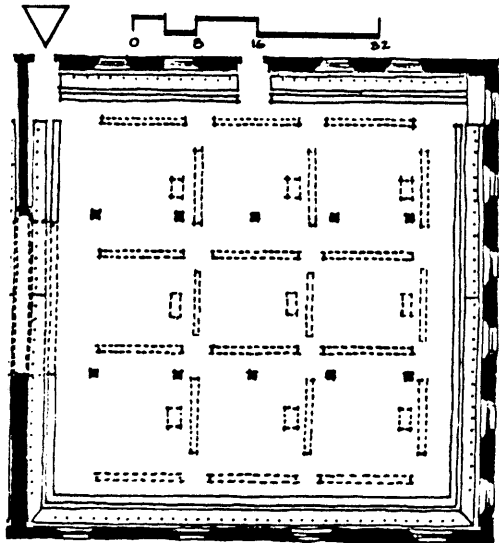
When asked to put human figures into a model of a room without making it too crowded, students put more of the figures in the same space if it is subdivided with partitions.⁽¹⁹⁾ This laboratory experiment has corrolaries in the real world. Rohe and Nuffer⁽⁶⁷⁾ conclude that partitions "mediate the effects of density". Increasing the density in a children's environment was seen to inhibit social development. (In environments with disturbed children it had anti-social consequences.) It also had a negative effect on the child's ability to

"attend to tasks with a clearly defined goal" such as puzzle solving. But when partitions separated activities and stimulation from outside was decreased there was more concentration on the task. In fact in testing varying densities with and without partition "the most constructive use of play materials occurred under the high density partitioned condition." They go on to conclude that "partitions may have decreased interruptions--removing this possible source of frustration."



The previous investigation of the Pierce school concludes that given a chance, there is a definite relationship between the position in which children perform a task and the amount of enclosure around them. (35) For example, students feel sufficiently bounded by low furniture if they are sitting or lying on the floor; if they are sitting in a chair then a higher enclosure is more desirable. This is privacy seeking behavior in that we are better able to control the environment if there is something at our backs. We feel more comfortable knowing some screen protects us from intrusions. Propst notes this natural tendency exhibited in teachers who, in undifferentiated open-plan schools, take the "best" spot for themselves (back to the wall) and lecture to an "exposed" class. (66)

"We fought like mad to keep the walls. It's a developmental issue of security and enclosure: five-year-olds go for enclosed space." (Devotion School teacher)



OPEN-PLAN SPACE FOR NINE TEACHING STATIONS ~ FROM J.C. LOUDON'S ENCYCLOPEDIA OF ARCHITECTURE 1839

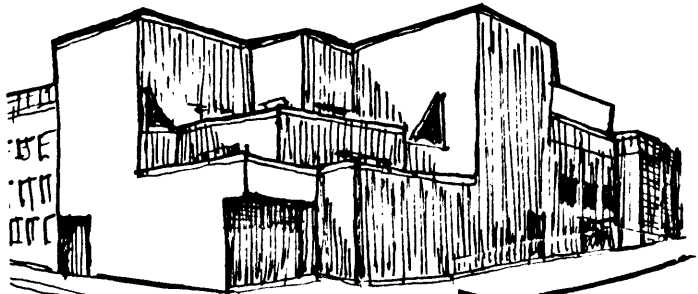
FIVE SCHOOLS

To get an idea of how open-plan schools were used, a handful of schools in the Boston area were visited. Five built in the last three to six years with distinctly open areas were observed, and many teachers were informally interviewed. Maps of many of the class areas, including furniture location, were drawn and activity areas identified. For this study, what was most important was the location and amount of furniture bounding the class areas. Architects of all the schools were interviewed.

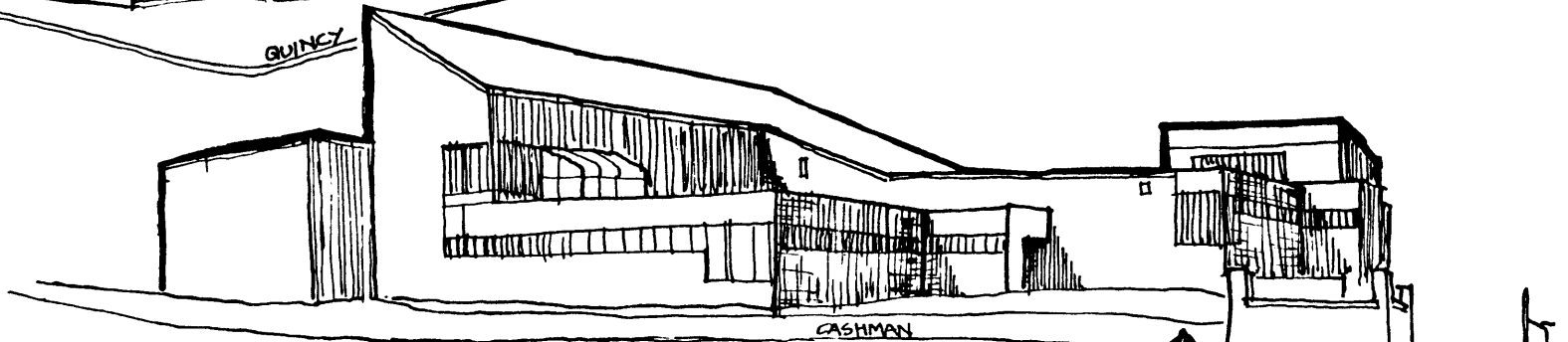
The most information was gathered at the Cashman school, where three teachers and the principal also provided written answers to a questionnaire, in addition to the many comments obtained in conversation. Class areas were mapped in detail. The next three schools, Pierce, Devotion and Lawrence, are in the town of Brookline, a suburb directly adjacent to Boston. Well known for the quality of its public school system, Brookline continues to attract families

with school-age children. This is reflected by yearly increases of 1%-2% in enrollment over the past four years, while surrounding communities experience declines. The three schools were all designed along the same educational program, with more or less adjustment to existing conditions and specific users' desires. Several teachers and the principal in each school responded informally to questions. Parts of the Pierce school's open space were studied in 1976.⁽³⁵⁾ A brief amount of time was spent in the Quincy school in Boston, mapping enclosure. In some schools it was possible to calculate the length of the perimeter of class area that had been built up with furniture as a percentage of the 'open' length. This gives an idea as to how much of the actual spatial openness the teachers thought was appropriate. In all cases the modified openness was much less than the designed openness. In the two schools where it was actually measured (the Lawrence and Quincy schools) the reduction of openness was extreme.

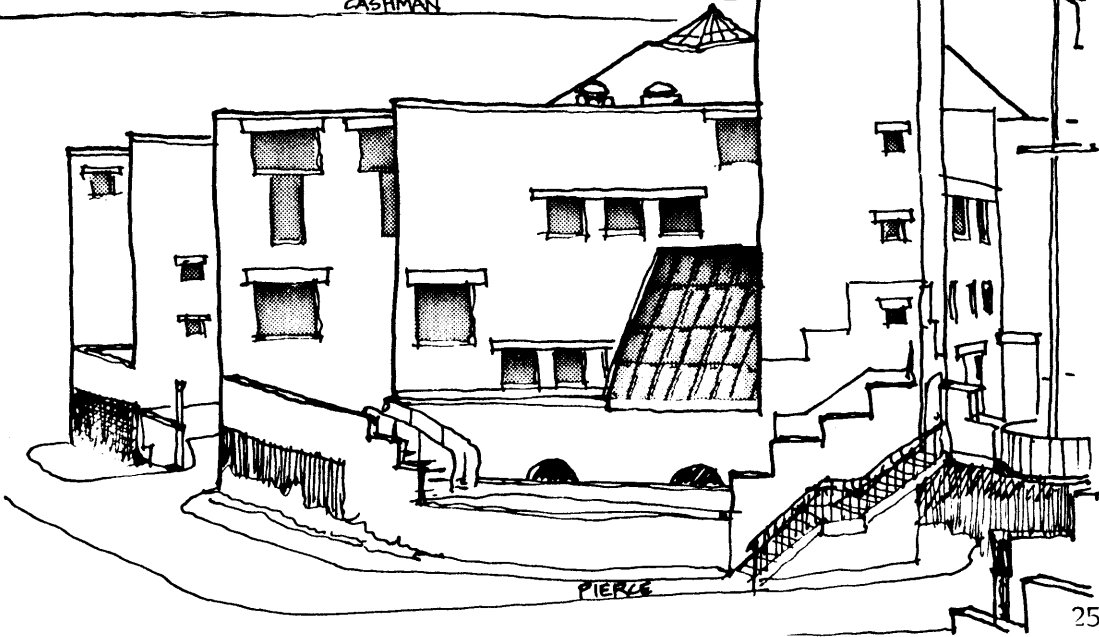
Other architecturally conventional schools in the area were visited for comparison, but not studied.



GUINCY

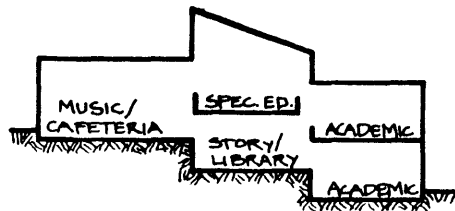
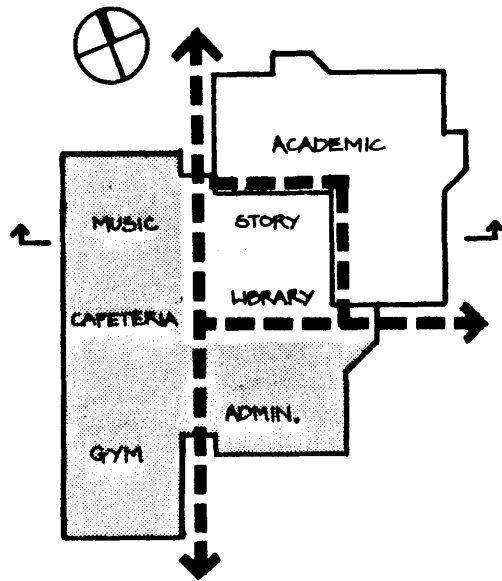


CASHMAN



PIERCE

CASHMAN

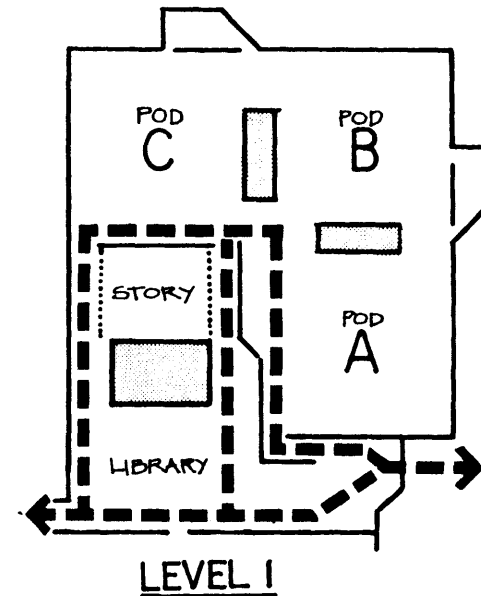


The Cashman school is located in Amesbury, MA; a rural community 50 miles north of Boston that is becoming increasingly suburban. Speed, as well as economy, was a primary consideration in constructing this school for a quickly-expanding population. One half of the building containing the cafeteria, gymnasium and music room (specialized, noisy functions) is separated from the rest by a major circulation spine in order to allow for community use. Administration and academic areas occupy the eastern portion.

The architectural organization of the school's academic area is in two "L"-shaped levels, each level containing three pods. Each pod accommodates four classes, so there are a total of 24 classes. The pods are all 60' x 60' with structural columns at 20' intervals. The three pods are separated from each other by bathrooms and wet project areas. Each pod contains children of the same grade, or nearly so. This study only looked at those four pods occupied by Kindergarten to 4th grades. (5th graders occupy the other pods.) Major circulation routes run along the side edge of the "L" while some natural light gets in the windows that run along the outside of the "L." Added to the outside of some pods are small group instruction rooms. The library on the other side of the access routes makes up the missing

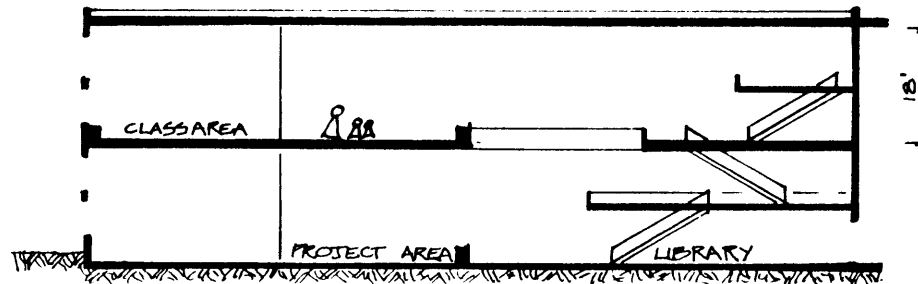
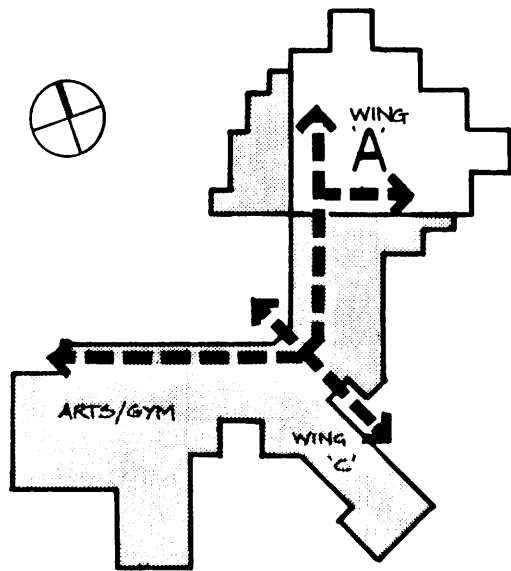
corner of the square located at the half level between the two levels of the pods. Next to the library is the "story room," a large group-room with seating tiers for film watching and other similar group activities.

	grade levels	number of students	number of classes	avg. # stud. per class	avg. sq. ft. per class	avg. sq. ft. per student
<i>as designed</i>	K-5	612	24	25	900	35.5
<i>existing</i>	1-5	618	24	26	900	34.5
<i>area studied</i>	1-4	366	16	23	900	39



PIERCE

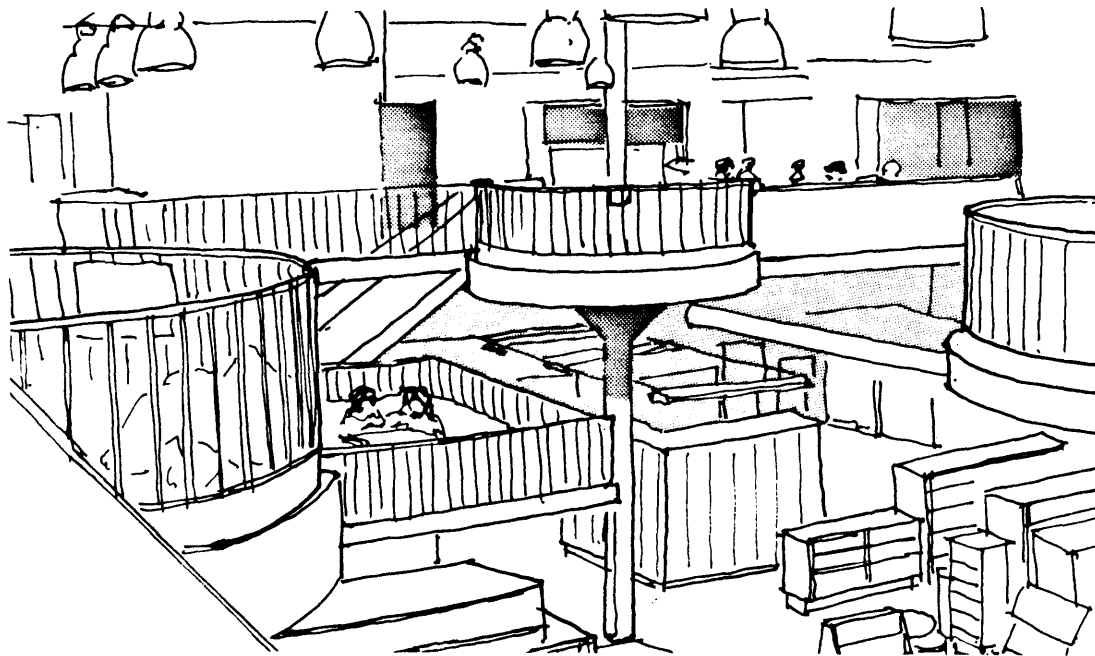
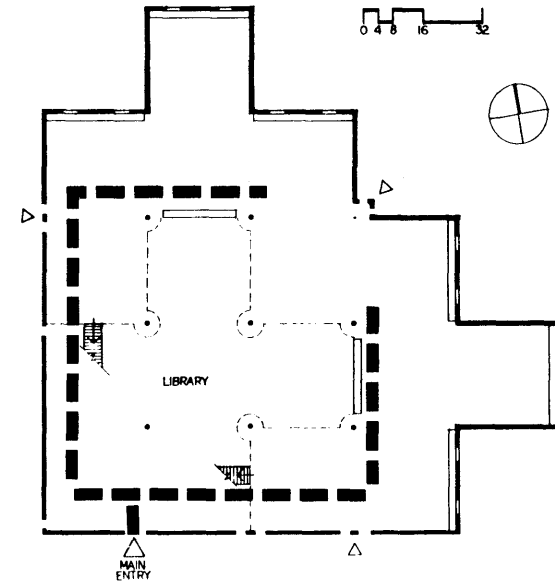
The Pierce school in Brookline, five years old, is organized in three wings, two of which contain classrooms. This investigation looked at the open plan wing "A" containing twelve of the schools' class areas. Class spaces and project areas are arranged on two levels around a multi-level library. The exterior wall jogs in and out to define all the class spaces with at least two solid edges, and windows for ample natural light. These bays and the structural system are on a 28' x 28' module. Ceilings are double height. While originally intended for older children,⁽¹⁰⁾ this wing contains a mix of grades. This is seen as a distinct advantage, "creating opportunities for cross-age work." Access to Wing "A" is at one corner behind and under the library; all traffic to class spaces or adjacent special use rooms passes around the library. Project areas abut each class space and may be shared in different combinations according to the teachers' desires.



There is one other space that teachers can take classes to for other activities, a performance pit which is at the circulation node of the 2nd floor.

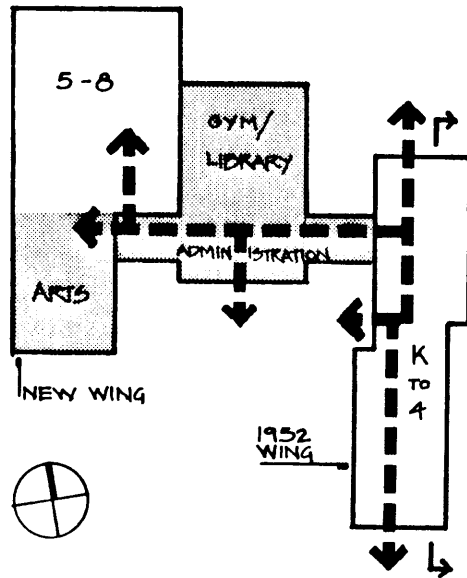
	grade levels	number of students	number of classes	avg. # stud. per class	avg. sq. ft. per class	avg. sq. ft. per student
<i>as designed</i>	K-8	675	27	25		
<i>existing</i>	K-8	599	29	21		
<i>area studied</i>	2-7	260	12	22	1372	62

'A' Wing

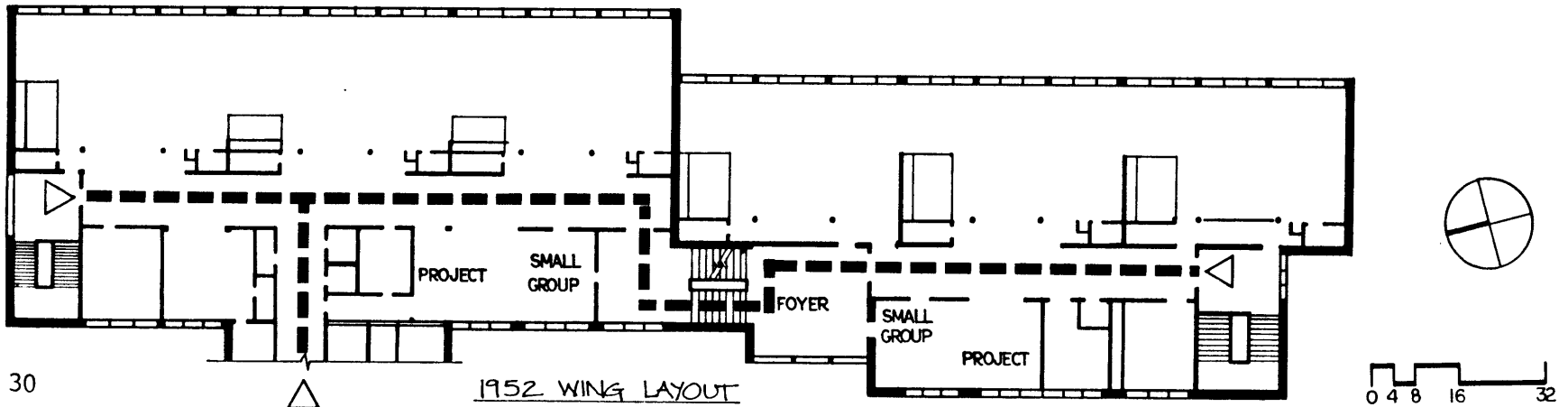


DEVOTION

The Devotion school, Brookline, MA, is a Kindergarten to 8th grade school, as are all elementary schools in the town. It was recently renovated and added to, and has been open for four years. It has two wings of classrooms; one on either side of the renovated 1913 wing, which contains administration, library, large group instruction rooms and other uses.

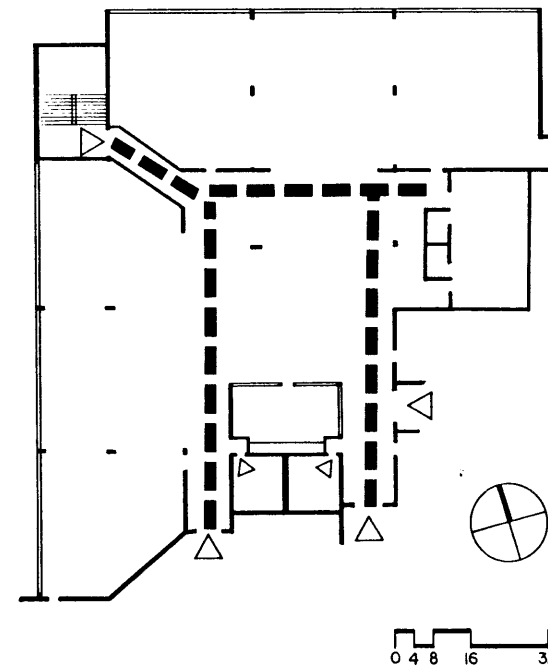
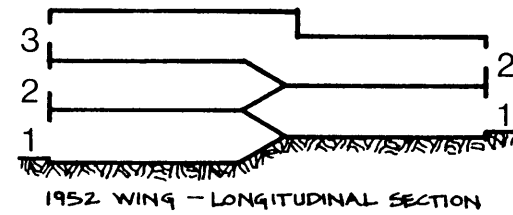


The renovated wing on the eastern side, originally built in 1952, contains Kindergarten to 4th grade students. There are five groupings of classes organized in two stacks at half-levels along a path. Each grouping holds one grade level, and age increases as you move up through the wing. The lower two levels of the 1952 wing is a double-loaded corridor building with the existing interior walls replaced by folding partitions. The old



classrooms remain the main teaching stations, while what was office space on the other side of the hall became project areas and small group rooms.

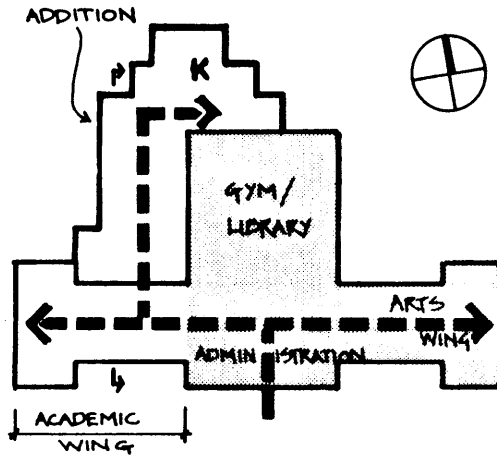
The newly constructed wing to the west, has two identical levels and accomodates the 5-8th grades, (younger children on the lower level). Each has six classrooms grouped around an open project area with closed project and small group rooms adjacent. Folding walls exist between most classrooms and in many instances, where three sides of a class area are permanent walls, total enclosure is possible. Though this thesis concentrates on the earlier grades, both wings were mapped, since their very different layouts were an interesting contrast. Currently the school has many more classes than it was designed for.



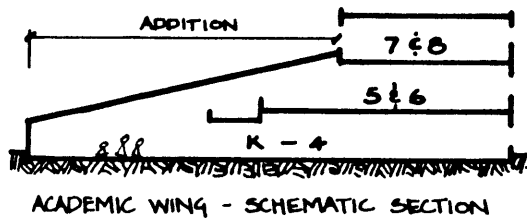
	grade levels	number of students	number of classes	avg. # stud. per class	avg. sq. ft. per class	avg. sq. ft. per student
RENOVATED, 1952 WING ONLY						
<i>as designed</i>	K-4	375	15	25	1240	50
<i>existing</i>	K-4	373	18	21	1030	50
<i>area studied</i>	K-3	282	14	20	1070	53

LAWRENCE

The Lawrence school (Kindergarten to 8th grade, Brookline) is also an added to/renovated building originally built in 1926 and open for five years. The original organization was a central section with two wings. The eastern wing now houses the arts and science areas, while all academic areas are in the western wing which is where the addition was built. The center section contains administration, library, gym, and large group instruction. The original central corridor remains the major circulation.



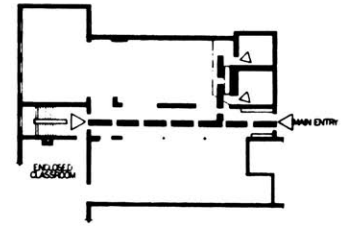
The classrooms, arranged on the three levels of the academic wing, have varying degrees of openness. The youngest students are on the ground level, where most of the additions were made. On each level there is one totally enclosed classroom. Others in the existing building are virtually enclosed and allow teachers to vary enclosure with furniture in the openings.



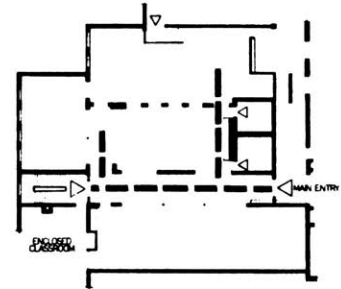
	grade levels	number of students	number of classes	avg. # stud. per class	avg. sq. ft. per class	avg. sq. ft. per student
<i>as designed</i>	K-8	550	22	25	1120	45
<i>existing</i>	K-8	488	23	21	1120	53
<i>area studied</i>	K-3	147	8	19	1450	84

first level

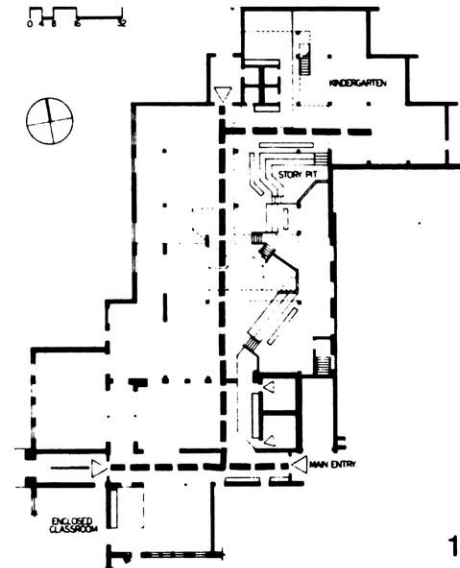
The first level's organization is that of a series of spaces off a path, that turns off the original corridor. Shared areas are intermingled. Two kindergarten classes occupy a relatively separate area at the end of the path. The second level for intermediary grades has five classes arranged around a large shared area. Circulation moves down one side of this shared space. The third level houses the seventh and eighth grades in an open area of four classrooms with a central path and no shared space.



3



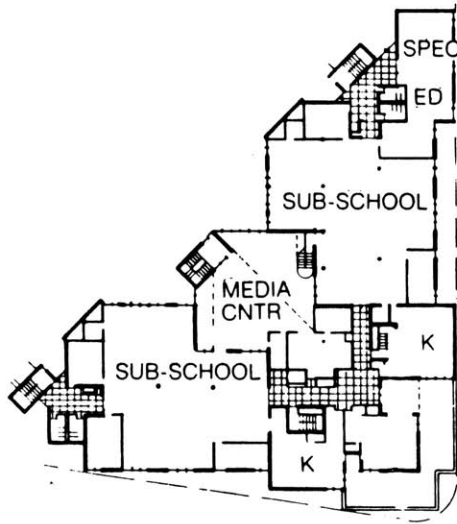
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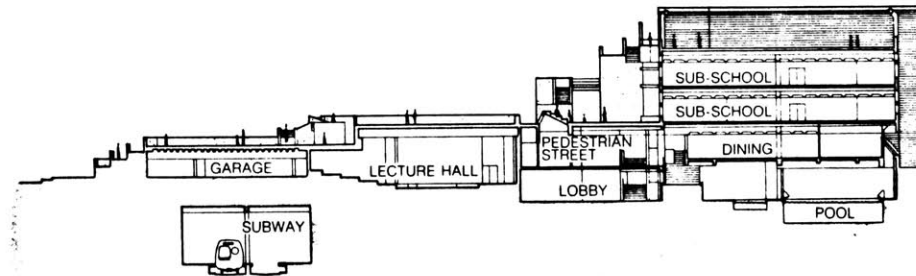
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QUINCY

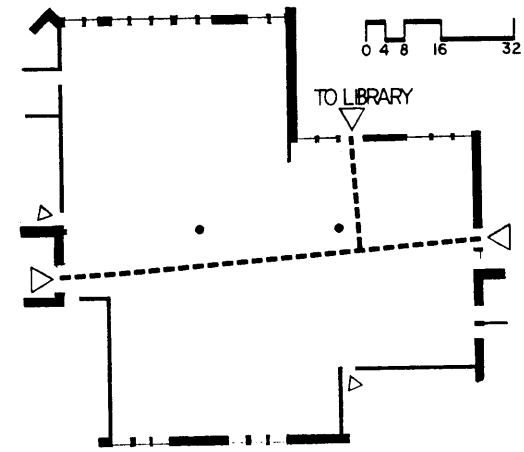
The Quincy school, Kindergarten to 5th grade, open for three years now, is operating at under designed capacity. Academic areas occupy the upper two floors of the building. Recreational uses, auditorium and cafeteria are all on the lower two floors for access by the community. Other community uses occupy other parts of the second (ground) level, which also contains the school administration, special education rooms and the entrance to the school.



	grade levels	number of students	number of classes	avg. # stud. per class	avg. sq. ft. per class	avg. sq. ft. per student
<i>as designed</i>	K-5	820	29	28	1096	39
<i>existing</i>	K-5	725	29	25	1096	43
<i>area studied</i>	1-5	600	24	25	1060	36



Both academic levels have two sub-schools; one on either side of the two-level library. These access into the vertical circulation "node" around which are grouped separate kindergarten spaces. The four sub-schools are identical with exits at either end. Within them are three enclosed rooms for special uses in addition to the open space that contains six classes each. More special education classrooms are located on these two floors, in the eastern corner. Each sub-school contains roughly the same age children.



Other schools visited offer programmatic as well as spatial contrasts to the five open-plan schools.

The Angier school in Newton, a suburb of Boston, is at least 50 years old. All classes are in self-contained rooms except for two that occupy the old library. The library now occupies the old auditorium. The two kindergarten/1st grades occupying the old library team-teach, as do other pairs of teachers despite the walls.

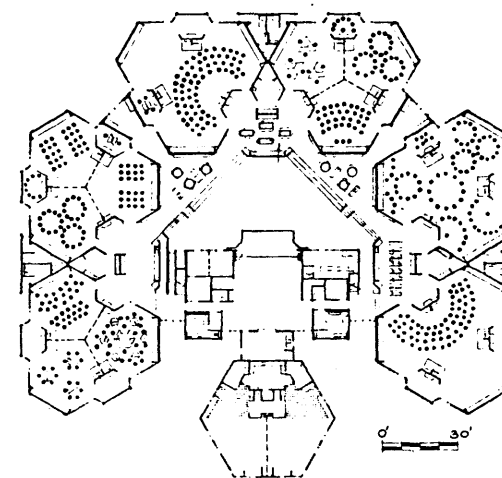
The Cambridge Alternative Public School program currently occupies an old parochial school building. The program is committed to an open approach to education. It is significant therefore that the principal said he would not want to be housed in an open-plan school, based on his knowledge of their performance. Talking with some of the teachers revealed that their classrooms did not offer the necessary range of privacy, and that an ideal situation for their program would be a combination of shared area and private space; noisy and quiet zones.

The Fayerweather school is a small, progressive, private school in Cambridge. Teachers have highly particularized their spaces with furniture, construction materials found and bought, and modular systems of their own making.

THE OPEN-PLAN

We have been building open-plan schools in this country for the last fifteen years. Through this life-span the shape of this building type has changed. Earlier open-plan schools have been called barn-like,⁽⁴⁴⁾ in that one huge space holds many classes with no fixed definition between them. In later examples, clusters of classes are defined in pods, thereby breaking down the numbers of people in one space. The schools examined here show this general trend towards more definition of each class space, yet remaining open. The increase in definition is a direct response to the problems of the large space, which has led to a great deal of dissatisfaction with the whole idea of open-plans. But there do appear to be some real benefits of some openness.

The primary reason for building open-plan schools are of course educational. Open-plan schools were thought to promote emerging methods of teaching. As the idea of the open-plan gained more support other rationales became popular.



typical pod school

It was suggested that in addition to being educationally progressive, this building type was cheaper and more flexible. These three rationales; reasons of educational practice, reasons of flexibility, and reasons of cost are discussed in order of increasing importance.

COST

Often in practice, the building's cost is a primary shaping force. Many architects and educators⁽²¹⁾ argued that building costs could be reduced with the open plan because: there were no interior walls to build, corridors weren't needed so space was saved, and a minimum of perimeter wall could be built because natural light penetrated further into an open plan building. Opinions have changed, and practice has refuted these contentions.

Windows, natural light and connections to the world outside are an important part of the classroom, certainly in more open programs where the outside is a learning resource. Every class area should be adjacent to the building's skin.

Circulation is circulation, and space gets eaten up by it whether in a corridor or in open space (discussed later in "circulation"). The allowances necessary for moving through the open area must be made by the designer.

As for the interior walls, the money saved is often spent on long-spanning structure, or expensive partitions. (See "flexibility.") Even if not, a lot goes into the greater amount of furniture (storage and screening) teachers typically use to define their space in open space. More important, acousticians, educators and behavioral scientists agree that more space per pupil is required in an open-plan than in traditional classrooms. Initial building costs and life-cycle costs of this extra space may make the open plan a costlier option. (64)

The architect, designing a building to fit a program of various needs, is aware that those needs may change in foreseeable or unforeseeable ways. To some extent, the design process involves trading off the priorities of addressing present with future needs. Flexibility, a worthwhile goal in any environment, is defined as the ability of that environment to accommodate potential and foreseeable needs over its lifetime. Needs change because values, goals, and modes of operation change. If a building no longer provides for these new needs it becomes obsolete. Consequently, if school buildings are to be cost-effective they must be flexible. The idea of the open-plan school, evolving at a time of great upheaval in educational practice, was embraced by educators and architects because it was thought to be flexible. (20)

*" The significantly increased floor space necessary to provide minimal separation between groups in an open space invariably is overlooked in economic planning."
(Yerges)*

" The question may well be raised as to what changes will be found in a (description of an elementary classroom) twenty years hence. It is clear that ideas of pupil-teacher relationships are changing. It is also evident that the relationship of pupil to subject matter is undergoing considerable revision." (Engelhardt, 1941)

FLEXIBILITY

If teaching patterns were changing radically at the time, who could say what they would be in a few years. So, at the same time that the open-plan attempted to accomodate open education, it tried to address flexibility. Unfortunately, like the use of the concept "open," the concept "flexibility" suffers from misunderstanding and misapplication. Nowhere is this more evident than in its use in the learning environment. Kevin Lynch⁽⁵²⁾ points to three meanings of flexibility which should not be confused. Summarized as environmental variety, malleability and adaptability, they indicate an implicit sense of time-frame, as well as space, to the idea of environmental flexibility.

" The act of learning itself celebrates choice." (Bernstein)

Environmental variety is flexibility in the present; it is the existence of options. The ability to choose amongst several different settings gives the user the best chance for as good a fit as possible to his needs at the moment. Varying the quality of adjacent spaces, rather than making them similar, provides options. Variables of concern are degree of enclosure, size and shape of space, and acoustical, visual and psychological privacy. To a lesser extent we must be aware of lighting, mechanical systems, access to storage and surface materials among other variables.

If the setting available does not match the users' needs,

then one of two things happens. Either the scope of the needs is modified to fit what the environment offers, or the user modifies the environment. If the user has to change his behavior, as in the first case, the environment is not flexible. If it can be shaped or adapted to suit, then it is. Malleability and adaptability can be thought of as two ends of a time and effort continuum. Malleability, at one end, is change involving a low amount of work that can be done quickly and frequently. In school buildings it typically involves low technology hardware and has few implications for other variables. Moving a blackboard to provide a screen, is an example of this end of the continuum.

On the other hand, adaptability, demands a lot of labor, takes time, and is seldom done. To facilitate adaptability in schools, highly technical solutions are usually employed, such as those developed by SCSD and SEF.⁽²³⁾ It is the type of effort done over a weekend or more, and often means changes of the environmental supports systems; lighting, ventilation, etc. Relocating partitions to create a larger room is an example of adaptation. An important function of adaptability, is the ability to adapt to growth. If a building is to be enlarged later, what is built now must be adaptable enough now to change in order to cope with new burdens on the total building and its systems.

From the teacher's and students' standpoint, working day to day in a certain space in the building, adaptability is not as important as manipulability and variety, simply because the former is usually outside the domain of their control. Adaptability is more the concern of the administration that decides larger planning issues. What types of flexibility are important, and in what order of priority, is critical to the discussion of designing for privacy in a learning environment. The question of how to provide the requisite flexibility is subject for debate; previous efforts, it seems, having often missed the point.

An investigation of elementary school activities indicates that in all class groups there is a need for various degrees (none, partial, complete) and various types (acoustical, visual, and psychological) of privacy, in most elementary level educational programs. Different combinations are often needed at the same time, and always over the course of the day. It follows from this that both variety and malleability of privacies and enclosure are necessary since the need is immediate. Both teacher and architect are responsible for providing some amount of each of these conditions. There may be some overlap between them, but while there are many levels of privacy that the architect cannot be expected to provide, there are many conditions the teacher cannot

create.

Given the proper equipment, any space closed or open, bland or varied, is manipulable. It just may take more effort and imagination (not to mention furniture and screening) to create a satisfactory classroom when the starting point has little articulation. The design of a learning environment should, within reason, support a number of opportunities for privacy. It can do this either by building in a variety of spaces in the first place, or by letting the wall configurations and other building features suggest enclosure that the users add to. If the architect makes a minimal amount of definition and says that the space is therefore flexible, he is guilty of passing the buck. (52)

"... a sea of space without territorial definitions, forcing occupants to the edge, resulting in less interaction and higher cost as unused footage becomes spatial buffer." (Propst)

No matter how little enclosure is provided, the typical class space is already well defined anyway, as the following examples show. In addition to the inevitable existence of the class group as an organizational unit, the ways in which a large space are used are to a great extent predefined by access routes and facilities such as blackboards, windows, sinks, and fixed storage.

One architectural device that is manipulable and used in many "flexible" schools, is the folding or accordian wall. These are usually fixed in one place, although

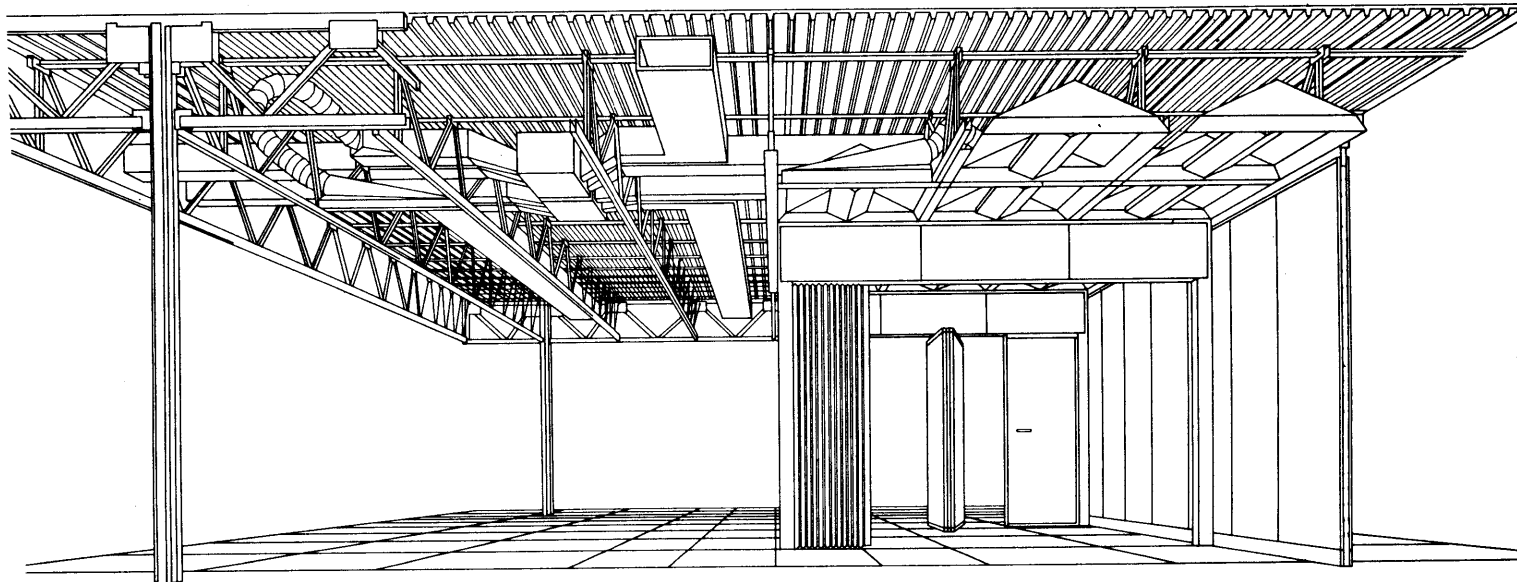
some adaptable building systems have also developed their own relocatable, folding partitions.⁽²⁰⁾ Based on the observable fact that so many of these folding partitions are either premanently shut or open, their use is generally unsuccessful. But on occasion a school is designed and used in such a way that these are a useful tool, as in parts of the old wing of the Devotion school. They are very expensive, over five times the cost of a standard framed partition.⁽⁵⁶⁾ And like demountable partitions their cost increases as they get better at reducing noise transference, and easier to use.

The idea that homogeneous space under long-spanning roofs is flexible in any sense of the word is misleading, but this is the kind of building many new schools have been (and continue to be) housed in. This is true whether the area is "landscaped" (to use the office-planning term) where furniture and partial partitions define spaces; or whether relocatable partitioning systems are used; or some combination. The problem is that when relocatable partitions are used in real situations, their adaptability cannot justify the architectural constraints and their expensiveness. However, without full height partitions, the full range of privacy needed cannot be provided.

In a large undifferentiated space, spatial variety with regard to privacy is non-existent. With a manipulable set of screens and/or furnishings, some levels of privacy are possible, but not all. A variety of visually and psychologically private sub-spaces can be created, but acoustical privacy is more elusive.

"The undifferentiated open plan...was rejected as a valid concept." (Pearson)

Adaptable buildings based on compatible building systems such as SCSD, SEF⁽²³⁾ feature relocatable mechanical systems and employ demountable full-height partitions. The relocatable partitions require uniform ceiling heights, similar ceiling treatment and lighting throughout, and a layout based on a simple five-foot grid; in short, space without variation.



They may offer acoustical as well as visual privacy in distinct rooms. They are not useful at creating intermediary levels of privacy. A full range of possibilities can be made with the addition of manipulable furnishings. The type of space generated by systems like SCSD and SEF is of questionable value relative to its adaptability. Certainly a good case can be made against employing complicated systems over more conventional building methods which can offer variety and are not, of course, unadaptable.

In 1958, several years before these school building systems were developed, Kevin Lynch⁽⁵²⁾ had written "... such unspecialized , "non-directed" forms may be of great value in maximizing present choice, but they are not necessarily more adaptable. Once occupied and in use, with partitions established, they may be as resistant to change as any other." Christopher Alexander⁽²⁾ points out that this is because change invoked by someone on one side of the partition affects those on the other. Mutual, and therefore more difficult decisions have to be made. People tend to resist giving up territory, consequently adaptability is only effective when large-scale replanning is dictated by a higher authority. But even so, is this in fact a useful tool and do the benefits justify initial extra cost? The partitions

themselves cost over twice the price of a standard wall.⁽⁵⁶⁾

A study by a multi-national education group (Organization for Economic Cooperation and Development: OECD)⁽⁶¹⁾ tested various programs in two school buildings and concluded that most programmatic changes required no modification of partitions, and that when some was needed it would be slight. In no way did a change in educational program justify the expensive relocatable partitioning system. They also agreed that while a structural frame construction was important to allowing future change, as opposed to load bearing walls, there was no need for long spanning structures (also expensive), since in practice the columns did not interfere with the use of space.

Is there in fact a need for adaptability? Uses do change, so buildings change function, but there is no direct correspondence between such a change and spatial change. As Lynch points out, it is a loose and limited linkage.⁽⁵³⁾ Alexander's description of using an old house as an ideal environment for office space is an appropriate analogy.⁽²⁾ There are generic patterns of use in all activities that transcend building types and room classifications. In the case of the schools visited for this study, the Angier school, where

*"...it seems evident, that changes in architecture do not, in and of themselves, make a great difference."
(Martin/Pavan)*

" Adaptability exists in spaces that offer choice." (Fawcett)

large closets had become special one-on-one instruction rooms, had provided for this new need just as satisfactorily as the modern schools. This confirms the OCED's opinion that adaptability is best served by the provision of spatial variety in the first place.⁽⁶¹⁾ Designers and planners justifying their systems approach argue that by fixing the built definition in this way, inflexibility results. However, complex buildings are not necessarily as inadaptably as buildings that are narrowly suited.⁽⁵²⁾ The irony is that the systems approach creates buildings that in fact are narrowly suited.

The compatibility of the systems, a major goal toward interchangeability, constrains the range of architectural possibilities to such a great extent, that resulting spaces are so homogeneous that they cannot fulfill all users' needs. Lynch and the OCED agree that the designer must plan for the stated present set of needs. If some change is foreseen and explicitly documented then it is easy to design to this too, but the present needs should not be sacrificed for that which is unknown. Designing with an emphasis on spatial variety with manipulable furnishings in mind, will in any event reduce the impact of future change and the need for adaptability. It is in these two categories design efforts should be focussed.

ACCESS AND COMMUNICATION

The original rationale for building open-plan schools was that they facilitate some aspects of an open educational philosophy. There may be some grain of truth in that idea, but educators are quick to point out that the two should not be equated. It seems that too many architects, building committees and educators have done so in the past, and discovered the differences too late.

An open plan can only foster open education in as much as the activities generated by such a philosophy are constrained by a room's enclosure and the singularity of such a space. In regard to the three behavioral implications of open education mentioned previously, (variety of simultaneous activities, variety of groupings, and flux of people), open space affects the flow of people beyond the classroom walls and the creation of groups from many classes.

Activities that take place within the class area are not enhanced by the lack of walls. This is borne out by observations in many of the schools where enclosed classrooms existed. In the Pierce, Devotion, and Angier schools among others, the activity-center layouts of enclosed classrooms manifest an open structured education process.

"Open classrooms are a matter of attitude and content, and not of simple architecture." (Cleverdon)

"...one can plan for privacy and still maintain an arrangement which permits a natural flow from one activity to another." (Jacobs)

The educational advantages of rooms without walls lie in the ability to communicate with others and to come and go from the space more easily without distracting others. Doors may inhibit spontaneous movement to the many destinations outside the class area.

As the education process depends more and more on a multitude of books and other resources, not all of which are in the classrooms, students spend a lot of time in the library and travelling to and fro. The importance of the use of the library in school life is evident from its position and size in the school. For all six schools it was the central element in plan. The new schools, Cashman, Pierce, and Quincy had organized the academic areas around it. The renovated schools, Devotion and Lawrence, and the Angier had all carved new libraries out of their old auditoriums which had previously been the central organizing element.

Increasingly, government mandated programs are increasing the flow in and out of the classroom. Programs such as "Title 1" and the mainstreaming of students with disabilities, are part of the trend to provide instruction tailored to individual needs.⁽⁴⁹⁾ Title 1 is a federal program that puts more teachers in the schools for remedial tutoring. Mainstreaming is the idea of keeping children with disabilities in school where as

before they might have been sent to special schools. Whatever the problem, physical, mental, emotional, or just the need for extra tutoring, more and more children spend some part of their day under the tutelage of specialists. The result is often a constant change in the makeup of the class. Educators point out that this process of pulling students out of class (or even sending specialists into the class) is "disruptive, time consuming and stigmatizing."⁽⁴⁹⁾ It would seem important for the students, especially students pulled out of class, to make this a less noticeable event. Openness can to some degree accomplish this.

" Interconnected spaces make for ease in assimilating extra adults to work with individual children..." (U.K. Department of Education and Science)

Team teaching in one form or another occurs in some schools. Defined as the sharing of responsibility for two or more classes between teachers, it involves flexible grouping of students. It may only occur at certain times of the day for certain activities, but when and if it happens, it is made simpler by the adjacency and ease of passage between the class areas involved. But it was noted that team teaching happens in enclosed room schools despite the walls. For example in the Angier school, teaming occurred in both fifth and sixth grades in addition to the cooperation in the large room. In the Cashman school, in Pod "F," where all four teachers team taught (they exchanged students to create various

ability groupings); one teacher said they might have done it in a closed school, but the openness made it easier. Other studies have noted the difficulty of attempting organizational variety in enclosed classrooms. (73)

" I really feel the largest benefit is to the teachers. So much can happen, given a chance. You get input from four people instead of one. So much sharing can take place. As a result, the children benefit in the long run from improved programs." (Cashman School teacher)

" I love the building and the interaction between kids and adults from other classes." (Pierce School teacher)

"...While in this sense supervision is greater than in a self-contained room, it is also considerably less obtrusive." (E.F.L.)

Whether or not team teaching or any educational exchange is taking place between teachers, the fact that teachers come in to more contact with each other is a very beneficial by-product of openness. Many teachers in this study and others, expressed the advantages of seeing each other more often during the day. They learned from each other, could be supportive of each other, and were on hand in times of crises. 32% of the 210 teachers Gump and Ross⁽³⁸⁾ interviewed cited the psychological benefits, mutual stimulation and camaraderie, of this togetherness in the open plan, and others concur. (44,70) In the Angier school's double classroom it was pointed out that one teacher could leave the room taking a small group to the library, knowing the other students were supervised. Teachers acknowledged the fact that they could get involved with a particular student or group and know that other adults were around if their other students acted up out of sight. (Other studies have said the same.⁽²²⁾) The sharing between classes of spatial resources, such as project areas, sinks,

bathrooms, specialized equipment, needs openness. Teachers need to be able to supervise their students using such areas. Children need to feel comfortable and confident in leaving an area they know is theirs and entering one where ownership is not so clear. Visual connections back to home base help them feel secure, an important prerequisite to concentrated work. (60)

Numerous studies of open-plan schools have not been able to completely clarify the benefits or disadvantages of open plan. They only confirm the opinion that the role of the architecture is not the determinant of behavior as some proponents may have thought because it is overshadowed by so many other factors. But we assume that the built environment is either supportive of, or a hindrance to certain behaviors and at some level evidence of this comes through.

Measuring the achievement of students in open-plan schools against that of students in conventional schools, probably encompasses too many other variables. Consequently, no consensus has been reached. (34) At least the open-plan does not seem to be conclusively detrimental in this regard. Similarly, studies of self-concept and pupils' attitudes show conflicting results. (54)

EVALUATIONS

" Architecture, because of its superstructural nature, can modify the environment directly; but it cannot dictate the activities that go on in the environment."
(DeCarlo)

" There are too many variables in most classroom situations for really rigorous scientific research." (William James, as quoted by J. Dewey)

Researchers, in comparing, have noted that in open-plan schools there was a greater variety of student behaviors, students worked in groups more and were in more communication with their teachers and peers. ⁽⁴⁾ That the "mean number of learning sites entered were greater in open schools than in traditional" i.e., students moved around using more of the space, and that open schools provided more of certain kinds of variety and stimulation. ⁽³⁷⁾ "That children are more free to move about and work together without bothering others, thus freeing the teacher for individual work with students," may be a great advantage of open plan, not completely attributable to the space, but probably helped by it. ⁽⁴⁴⁾

Most evaluators have found less change in open-plan classes than was expected. They attribute this to lack of change in organizing structure and teacher habit. ⁽⁴⁴⁾ The fact that, for many, seat work still predominates, and that only the walls have gone; the blackboards, desks, shape and size of the class area remain the same. ⁽⁴⁾ Maybe the best case against openness is that the hope for the "school as a total educational resource" has not in fact proven realistic, ⁽⁴⁾ therefore why is the openness necessary?

DISTRACTIONS

The major benefit of the increased sense of communication and interaction, is also the root of the problems. Lack of privacy and distractions, both aural and visual, detract from the learning process. But it is important to acknowledge to what extent these are problems of openness of space versus results of more open educational practice.

Implementation of an open education policy or some approximation of one, creates distractions and privacy problems no matter what the degree of spatial enclosure. Because of the number of activities going on within the classroom at any one time, there will be distractions and extraneous noise. A great deal of aural and visual stimuli, commotion, is obviously accepted as part of open education, but some of it may conflict with other activities. When that happens and tasks cannot be completed as a result, there is a need for privacy. At least in a conventional closed room the whole group, which is responsible only to itself, has privacy.

When the walls are removed, potentially conflicting situations multiply or are controlled by other than spatial means. Now the effects of the activities intrude upon the community, and each group must be respon-

" There are a lot of 'socializing' activities and role-playing that I don't use because of noise level." (Cashman School teacher)

"... it appears that contrary to popular expectations and beliefs facilitated by the disparity in the connotation of the term 'open', there is likely to exist in open schools a tendency by school personnel to implement rules and standard procedures to control behavior and interaction formerly controlled by physical barriers. This suggests that open facilities are often new houses for old behavior. Even though open space schools are thought to facilitate increased flexibility (in formal structure), it appeared that open space indirectly facilitated functional rigidity rather than functional flexibility." (Larany)

" The spatial barriers dissolved with the classroom walls then come to be replaced by the temporal dividers of timetables which were often absent in the old situation in the infant's school. In this way some aspects of the educational experience can become more, rather than less, formal and even the variety of activities may be reduced." (Evans)

sible to that larger body. Gauvin notes that this may constrain behavior in the class area, and that students indicated teachers communicate greater tension due to their fear of disturbing others. (34)

Certain activities that involve a great deal of commotion that could take place in a room may no longer be possible, may have to take place at a prescribed time worked out by teachers, or may have to take place in a separate special purpose room. "The more innovative and expressive aspects of the classroom--e.g., dramatics and creative movement--may be inhibited by the more public setting." Teachers reaffirmed this opinion at both the Cashman and Pierce schools, and one quarter of those surveyed by Gump and Ross (38) cited having to do without certain activities because they would disturb neighbors.

In 1976 Gump (37) noted that an inflexibility of programming tended to occur as a result of this problem. The desire not to disturb one another led teachers to schedule quiet and noisy times together. Making the scheduling of activities more rigid defeats some of the objectives of an open education. What has happened is that the "hard" structure has been replaced by "soft" structure. The walls have given way to administrative forms of activity definition.

That teachers are forced into a less than optimal teaching program because they have to regulate or limit parts of it is probably the best reason against the open plan, assuming that students are losing out as a result. Of course, if as in many schools, other private spaces are available for these activities, the problem may be partially solved. Then it becomes an issue of scheduling use of this shared space and its proximity to the "home territory."

The farther from the class area such a space is, the less it is likely to be used, since that would involve more effort and planning. The Cashman, Pierce and Lawrence schools have "story pits," tiered areas for group watching or performing. At the Lawrence school it was in the middle of the academic area but completely exposed; it was "not used that much." At the Pierce school it was at the center of the school in the middle of the major circulation path. Teachers at the Cashman school complained that theirs, also bounded by circulation paths, was not private enough. Noisy activities in the story room disturbed the adjacent library and people walking past disturbed the activity in it. Teachers also felt that the tiering at Cashman was too constraining since it was the only "private" space they could use,

*"I do miss being able to use the quiet rooms. At my last school, we had conference rooms which were large enough for a whole class. These were in constant use. I find there is nowhere to take the group to do an especially noisy or quiet activity. There are activities I don't do anymore, because they would disrupt the whole area."
(Cashman School teacher)*

it did not allow exercise, or activities requiring movement.

The Devotion school is the best example of providing a variety of places to the users for noisy or quiet activities while remaining open. (Unfortunately at this time many were being used as overflow classrooms.) The new wing has conference rooms, shared "noisy" rooms and shared "quiet" areas. (Designations per architect.) The old wing has enclosable group rooms and project areas. Thus teachers, if these rooms had not been in use by overflow classes, would have had a variety of space in which to conduct activities. They would have had the option to go into an enclosed room if they didn't already have one. Or they could share an open area with other classes if they wanted to get out of the room.

ACOUSTICS

Acoustic studies of open-plan schools show results contrary to popular belief. Noise is a consistent complaint of teachers in these schools. Informal interviews are consistent with Gump and Ross' survey⁽³⁹⁾ which cites 37% (over and above those that cite distractions). Acousticians point out however that it is not noise level (the volume) that is distracting, but other aspects of the acoustic environment.

" No single type of teaching space can provide an adequate solution to the acoustic needs of primary school users." (Lewis)

Obviously, there are limits as to how much noise can be tolerated. Over and above a certain noise level the situation becomes unworkable; teachers find themselves shouting to be heard at small distances, the effects snowball and things get out of hand quickly. In the Pierce school, the principal sounded a chime throughout the open space to indicate the noise level was becoming excessive. Studies indicate the noise levels in open plan schools are not usually at that level. Walsh⁽⁷⁴⁾ suggests maximum allowable levels of 65 dB(A) (decibels), whereas Yerges⁽⁸⁰⁾ found mean levels of 55 dB(A) in a study of buildings in nine school systems.

Studies also show, despite some opinion, that noise levels are much the same in open-plan as they are in conventional classrooms, given similar types of programs.^(11,80) (One study that shows open plan levels slightly higher, indicated it was not enough to affect performance.^(Kyzar in Gauvin 34) Some teachers at the Cashman school indicated they were no more concerned with the noise now, than they had been in an enclosed room. In any event, a study concerning the effects of noise on reading comprehension "detected no adverse effect on performance," although students did tend to work more slowly.⁽⁷⁵⁾

The real issue is the variation of noise level and discernability which in fact cause distractions. Students say that "the talking of other students, not general noise, is most distracting."⁽¹¹⁾ This attests to the fact that the part of the noise that is intelligible, or almost so, takes one's attention away from the task at hand because it has meaning and is information the mind understands. "White noise," noise without meaningful content is easy to disregard within these normal levels. As experts discovered in their experience with the open plan office, it is possible to render much of the noise unintelligible by masking it with the proper amount of "white noise." This raises the sound level only slightly and insignificantly, as it engulfs mentally stimulating sounds, or at least breaks them up. Although in the closed classroom there are fewer sources of sounds, each one is more discernible. In open space, the activities across the space generate so many sounds that a fairly effective "white noise" exists.

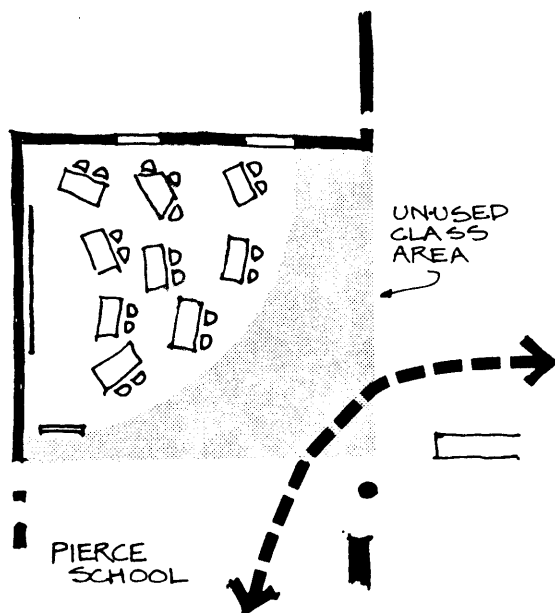
Variation of noise level has an effect on the behavioral phenomenon of acclimation. When levels are more constant, students may become less aware of the background stimuli. If the level varies there are more "surprises" to grab the attention. Yerges found that closed class-

rooms in fact had larger variations in levels than open space (even though averages were the same).⁽⁸⁰⁾ Distracting sounds coming across in lulls in the background noise are therefore picked up more frequently in closed rooms.

Researchers have discovered that complaints in school environments about acoustical conditions correlate closely with the reverberant quality of the space.⁽⁸⁰⁾ Thus all agree instructional spaces should not be "live."⁽³²⁾ Surfaces must be sound absorbing; carpeted floors, acoustic ceilings, etc. The regular, reflective surfaces of conventional four-walled classrooms tend to reinforce sounds making them more perceptible. The absence and irregularity of partitioning devices in the open plan are more effective in dispersing sounds. For this reason, Brunetti says the open plan can be a superior acoustical environment.⁽¹¹⁾

As mentioned before, acousticians have determined more space is needed in open space schools than conventional schools. Many have observed the "non-functional barrier/zone" surrounding teaching stations of more conventional teachers.⁽⁴⁾ When signal-to-noise ratio (the level of what you want to hear over what you don't) is used to

model class areas based on "chalk and talk" teaching styles, double the square footage of enclosed rooms are required,⁽⁷⁹⁾ much of which is buffer zone. (No screening whatsoever.) Similar conclusions were drawn by Walsh based on a population density vs. background noise level, keeping the maximum 65 dB as a limit.⁽⁷⁴⁾ But when Yerges⁽⁸⁰⁾ compared open-plan schools where the users were "reasonably satisfied," with conventional space allocations, only a 30-55% increase was deemed appropriate.



Signal-to-noise ratio increases (i.e., conditions improve) as the distance between listener and speaker decreases relative to the distance between the listener and the sources of noise. This typically happens when the population density decreases in a space, or when, as in a more open educational program, people are gathered in smaller groups. Obviously the lecture format suffers most in open plans because of the relatively large distances teachers have to communicate across to reach students in the last row. The physical ramifications of this were seen in several schools where the students' desks were huddled into a corner of the available space close to the blackboard.

VISUAL FIELD

Information on visual issues in open space are not as well researched as acoustical ones, primarily because visual stimuli are much more difficult to measure. Brunetti's study⁽¹¹⁾ shows that "acoustical distractions are more influential than visual factors" in disrupting students, presumably because it is harder to focus the ears, than the eyes. However, it is not entirely possible to separate the two. Research⁽⁸⁰⁾ finds that decreased visual distraction enhanced users' perceptions of decreased aural distraction. Thus it may be that in part visual 'clutter' is translated into 'noise' by the users in an attempt to explain the large amount of commotion they perceive.

Acoustical phenomena appear to have some visual analogies. Like the signal/noise ratio, the distance between viewer and the source of information is critical. The longer it gets, the more likely peripheral activities or movement will be perceived and distract the student. When students focus on something close in front of them it is evident, from walking by, that a visitor's presence is less distracting. Again, more conventional classes where students sit in rows looking at a blackboard at a relatively far distance from the focus of their attention, are bound to have more problems in open space than a program where small group interactions are the rule.

"A visitor causes little or no stir among children or staff. (A visitor to a standard classroom can be a disrupting experience.)" (E.F.L.)

" Clutter in the visual task may be thought of as the visual analog to noise in the auditory task."

(Larson)

As with acoustical stimulation, some teachers said they felt students got used to the cluttered visual environment, and Olds⁽⁶⁰⁾ suggests that richness in the visual environment is important to stimulating the student. However, she points out, perceptions of the vastness of space as in some open-plan schools can be "over-arousing" and therefore feel uncomfortable. So it was not surprising that one teacher thought a highly defined open plan, was not a visually taxing environment because at the children's working eye level, sub-enclosures blocked sight lines.

Brunetti⁽¹¹⁾ studied the relationship between students' perceptions of noise and their need for privacy in schools of open plan and conventional design. Part of his conclusion was that open space "does not automatically result in higher distraction or lower privacy as perceived by elementary students." Distractability is also a function of the student and of the task being done. Teachers often say that the open-plan is more appropriate for some students than for others; that it depends on the student's own self-discipline. Evans⁽²⁷⁾ suggests that more informal settings may favor certain children over others as a result. And of course there are some tasks that require little concentration, while others need much. With so many variables, task, student and

program, it seems that any learning environment must accommodate a variety of privacy needs, while still keeping options open.

Studies of privacy in the open plan show somewhat differing results, perhaps indicating that there are very different possibilities for achieving privacy in the different schools observed. Venezky⁽⁷³⁾ mentions the problem of the lack of privacy in open-plan schools and interviews with students⁽²²⁾ have generally said the same. Brunetti⁽¹¹⁾ suggests however, that open-space areas provide more privacy, presumably because there are more places outside the class area where the students can go. Teachers' opinions have also been mixed. Those teaching in open-plan schools are generally supportive with reservations, according to one study.⁽⁶⁵⁾ Teachers like the "fluidity and flexibility" but also want to "escape," to get away from all the activity.⁽³¹⁾ But in many school districts where there is a choice, teachers opposed to the idea may have gone to other schools with conventional rooms, thereby biasing such studies. In this study, except for the teachers at the Quincy school in Boston, teachers were mostly positive and enthusiastic, but again with some reservations.

Probably the best way of explaining these reactions to

" For an individual to have control over a sensed condition of environment means simply that the person possesses the response capability to cause that condition to vary in as many of the possible ways that it can." (Wise/Kahle)

DEFINING SPACE

noise and visual stimulation is that where there are more choices, the users will be more satisfied. When teachers and students have no options they will be less so. As a result, 'noise' as well as lack of privacy, are perceived as problems, even if the noise is not greater in an open-plan school than in a traditional school as some studies say.

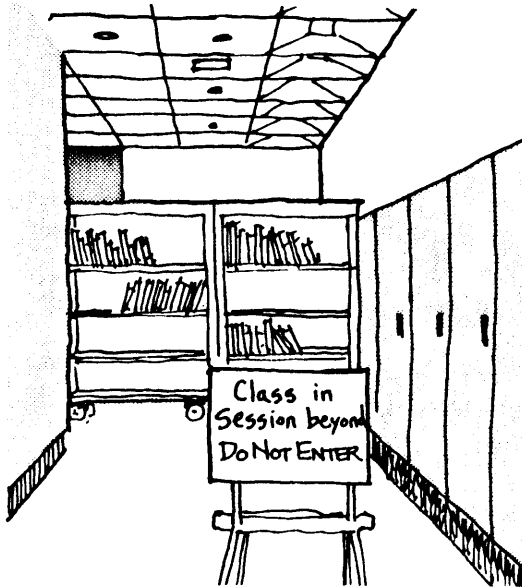
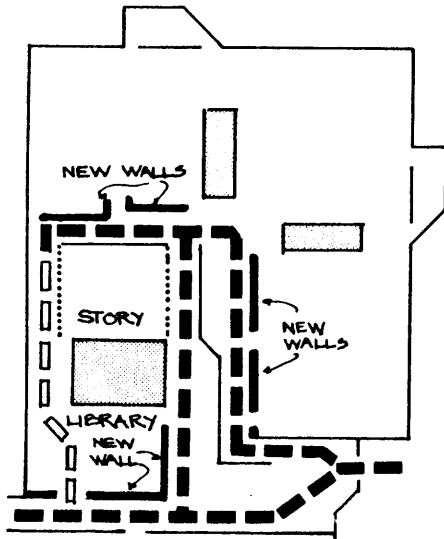
Circulation in the schools observed is such a problem that the issue demands a good deal of attention. The main purpose of the open plan is, as mentioned, the "freedom to circulate without there being a special independent function of circulation."⁽⁶⁴⁾ But the second-half of this statement is untenable in light of the way the schools observed operate. In the ideal open program where everyone works to their own schedule, no defined circulation space might be feasible. The majority of programs however, like those observed in and around Boston, depend heavily on the scheduling of resources (gym, music, etc.) based on the unit of the class. So two types of flow are present in these schools. A class moving as one is a very different condition from individuals going about their work alone. The distinction must be acknowledged.

It is a case of the whole being greater than the sum of

the parts. When large groups circulate through open spaces they almost unavoidably create a disturbance. Even if hushed, a class group generates distractions visual and other acoustical stimuli. This is not activity in the background--too often it is too close and too big an event to be disregarded. It is also one of the few most disturbing activities that cannot be avoided. Singing, exercising and other noisy activities can be done elsewhere or be suppressed, but circulation in groups is a fact of life. Typically, the class moves as a whole to lunch, recess, gym and many other events. Because of scheduling they typically move at different times from other groups who may be involved in concentrated efforts at the time. There were very definite responses to this problem in one form or another in all of the open schools visited.

It is evident from this and other open-plan school evaluations that given class groupings, there will always be a well established set of boundaries between territories. Just as teachers have responsibility for a certain number of children, so are they in charge of a specialized space. The building may prescribe the areas, as does the Pierce school with its articulated plan-form. Or they may be left slightly ambiguous, and yet have other building elements essentially define them.

CASHMAN



Almost four years after moving in, the Cashman school has erected walls separating the circulation paths from the pods, and from the library. These are permanent walls despite the fact that Cashman was designed for demountable partitions. In addition, one pathway behind the "story room" through to the library is "restricted." Despite these efforts, and the story rooms folding partitions, some thought it less than useful because it is "in the middle of traffic."

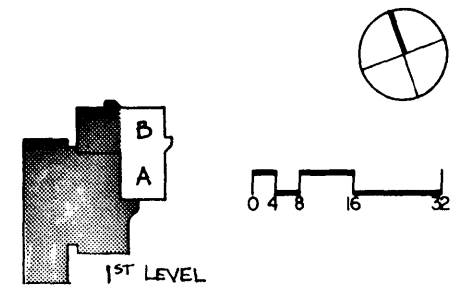
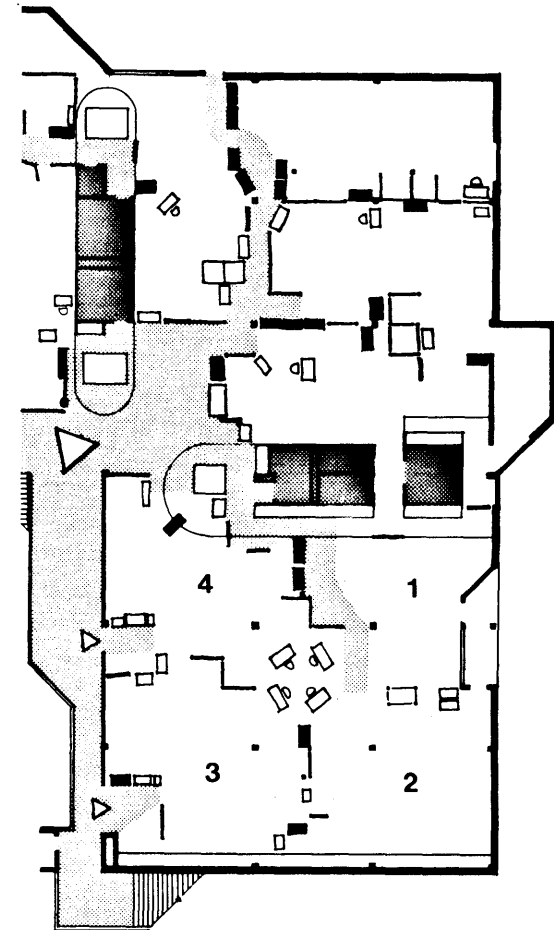
The library has undergone a major transformation from completely open to mostly enclosed. Surrounded on three sides by major paths of the circulation, it was vulnerable to numerous distractions. The area used by the library is now reduced from what architects' drawings suggested it might be (in addition to the loss of the lower area of the library, taken over by "special needs" users). Circulation along one edge has been restricted and walls have been built along the remaining two trafficked edges.

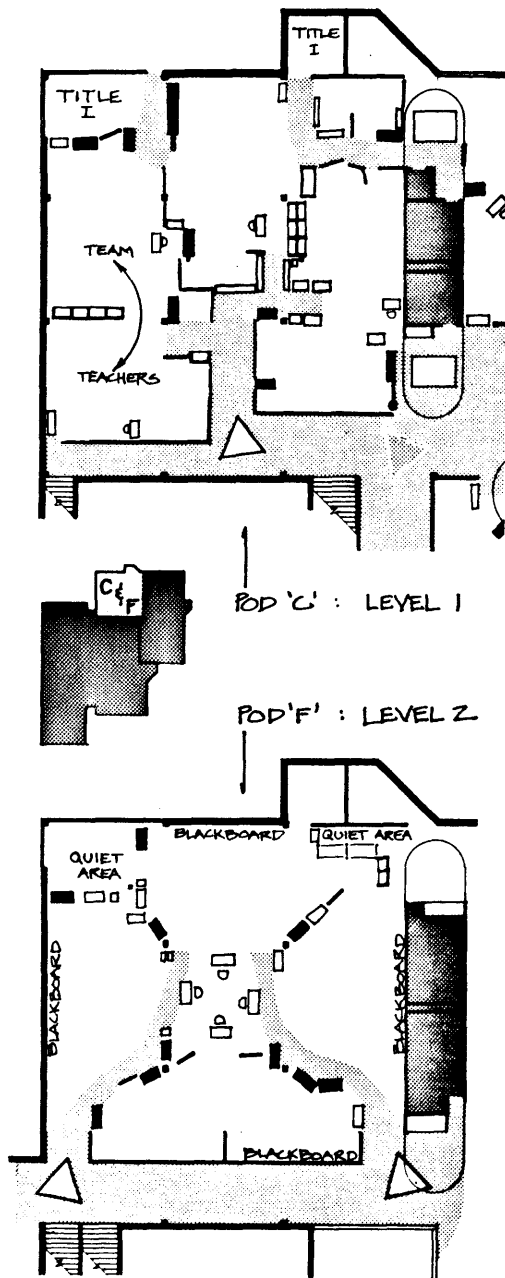
The use of the Cashman school pointed out how important the access to the class space is in determining the use of the space, and how the physical form affects access. The classes in each pod tend to move together to recess and lunch, etc., at different times from other pods, but

may move on their own schedule for other activities. The frequent occurrence of having four classes walk past a pod where students are working made it necessary to erect walls. For other activities (music, art) classes within the pod move at different times. Although the pods are all the same size and shape, the new walls separating them and the circulation create such different entry conditions that paths within the pods are also very different. Consequently, it affects the way the four teachers have divided up the space.

In pod "A" two classes (3 and 4) enter their areas directly from the major circulation, while the other (1 and 2) have agreed to a path along the wet area, trying not to encroach on the space of 3 and 4 who are a different age group and have a somewhat different schedule.

Pod "B" is entered at one point, the corner, and is consequently organized in a way unforeseen by the architect. The area around the entry point becomes a major node, and so this corner cannot be used by any class. The main path within the pod originates here and cuts through the pod to the class area furthest away, and the door to the outside. The separations between this path and classes, and boundaries between classes are well defined by furniture; though not that high, the enclo-





sure is relatively continuous.

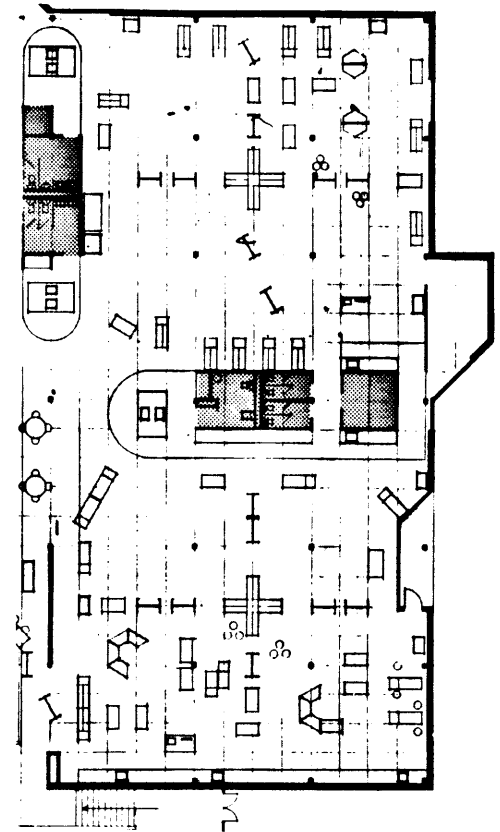
Pod "C" has a well-defined entry halfway along one side built into the new wall that separates pod from circulation. Other possible access points are all but blocked off. The pathway that leads through the pod starts at this entry and is heavily built up.

Pod "F," which is right above "C" is different because the new wall built to separate the circulation has no center entry as at "C." Instead, entry into the pods is at the corners. Inevitably with this pod arrangement, one or two classes are hard to get to while the others must bear the brunt of these groups going back and forth.

Over and above the circulation and entry points, blackboards had determined locations to a great extent in pods B, C, and F. In pod "A" where use of the blackboard is not as important, the classes are organized one to a corner of the pod. This may have happened because it was the easiest way to divide up the pod orthogonally, but it also gives each class area the greatest amount of enclosure. Compare this to pod "F" where older children (4th grade) are being taught with more use of the blackboard. The pod has been divided evenly into four, with teachers' desks in a circle at the center in exactly the same manner as in "A," except that with the focus on

the board, each area is triangular. The organization of pod "F" could not have happened in this manner if an entry point had been created in the middle of the new wall as in pod "C" directly beneath. In fact the one teacher in the corner of "C" has only a small portable blackboard. Both "C" and "B" have the heaviest amount of definition around class areas. (There is little division between the two teachers in pod "C" who are team-teaching.) Apparently, the architect expected an orthogonal quartering of the space despite the location of the fixed blackboards. (The drawings show the fourth wall with blackboard, but this wall was not originally provided and only built later.)

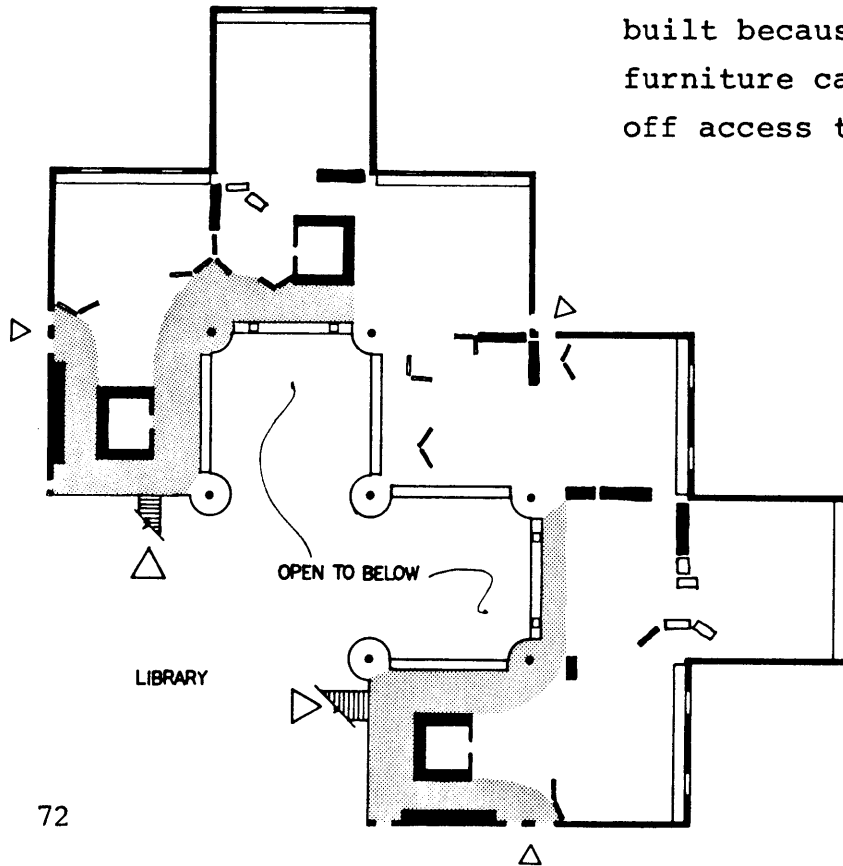
Shared areas present problems in pods with four (or more) groups in them. Again, as with circulation, someone gains and someone loses out. This applies to access to sinks, windows, and small group rooms in the Cashman school. (Small group rooms in this school have mostly been taken over by Title I teachers, as had one corner of pod "C.") Even when shared areas are created consciously by the teachers, like the quiet corners in pod "F," they are not readily accessible by one class.



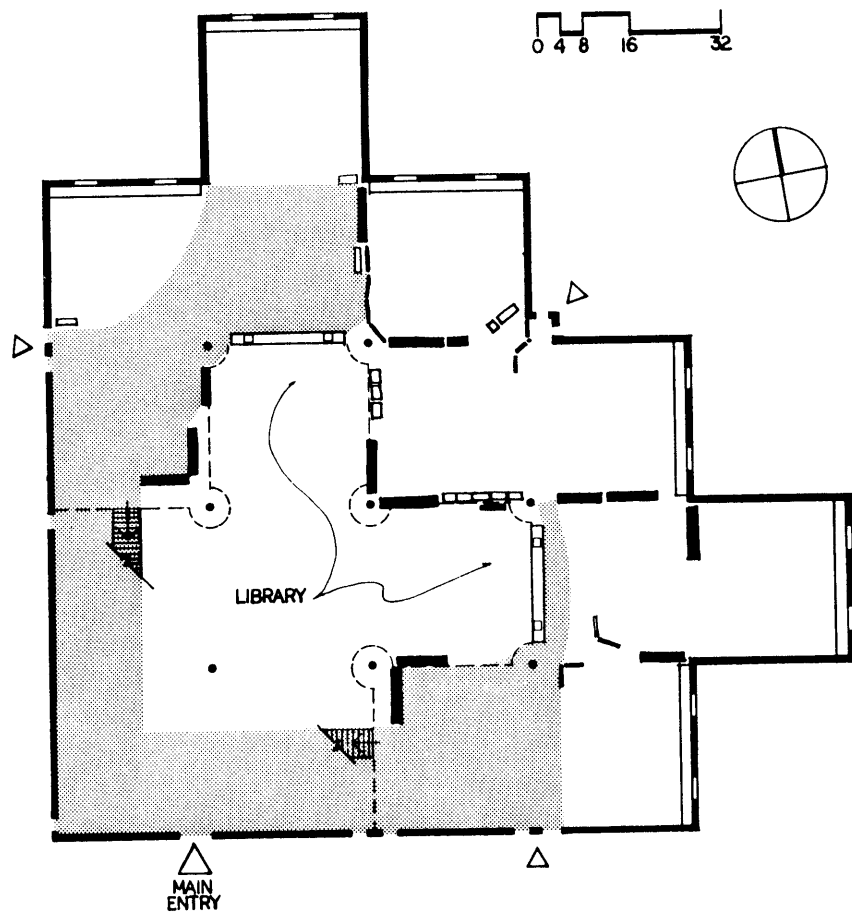
ARCHITECT'S DRAWING SHOWS
POSSIBLE FURNITURE LAYOUT

PIERCE

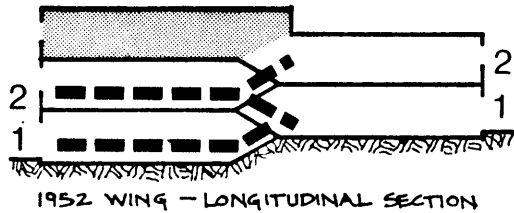
Circulation paths on the upper level at the Pierce school have to go through some of the classes and project areas in order to reach the furthest space. For one teaching team it is a real problem they have learned to live with. Since the path is unidentified, the teachers have to accept the fact that they cannot put any furniture in a five foot wide swath in front of their sinks. The fact that the shortest route is in front of the sinks causes problems of things disappearing or being tipped over. No walls can be built because of the eighteen foot high ceilings, and no furniture can be used to define the path without cutting off access to the sinks.



On the lower level, access to adjacent rooms cuts paths through two of the 28' square bays that according to drawings were to be project areas. Now, they are little more than circulation space. Whether or not it was the teachers' choice not to use these areas, they are difficult spaces to claim.

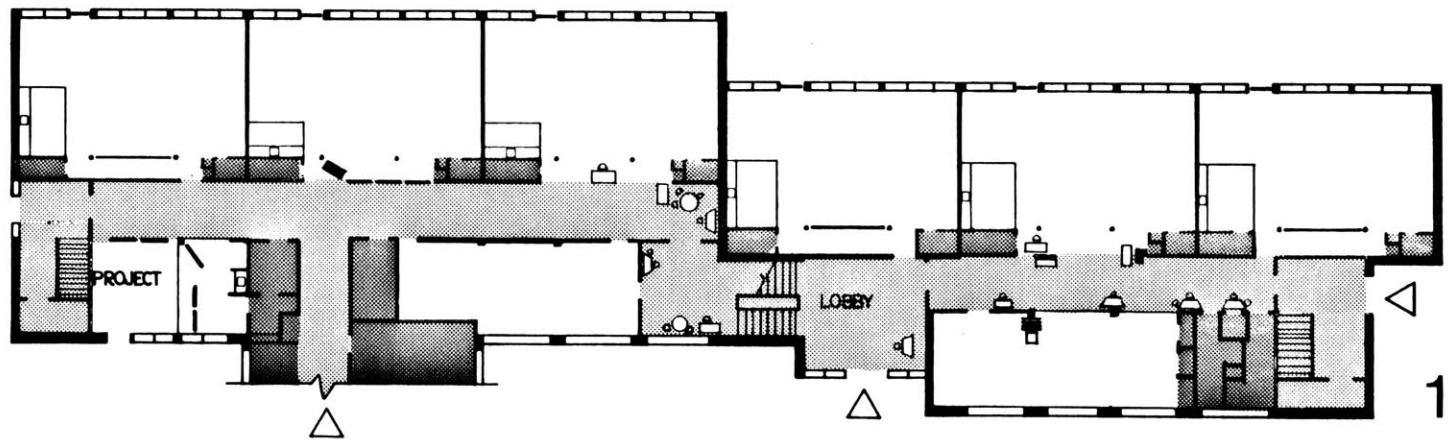
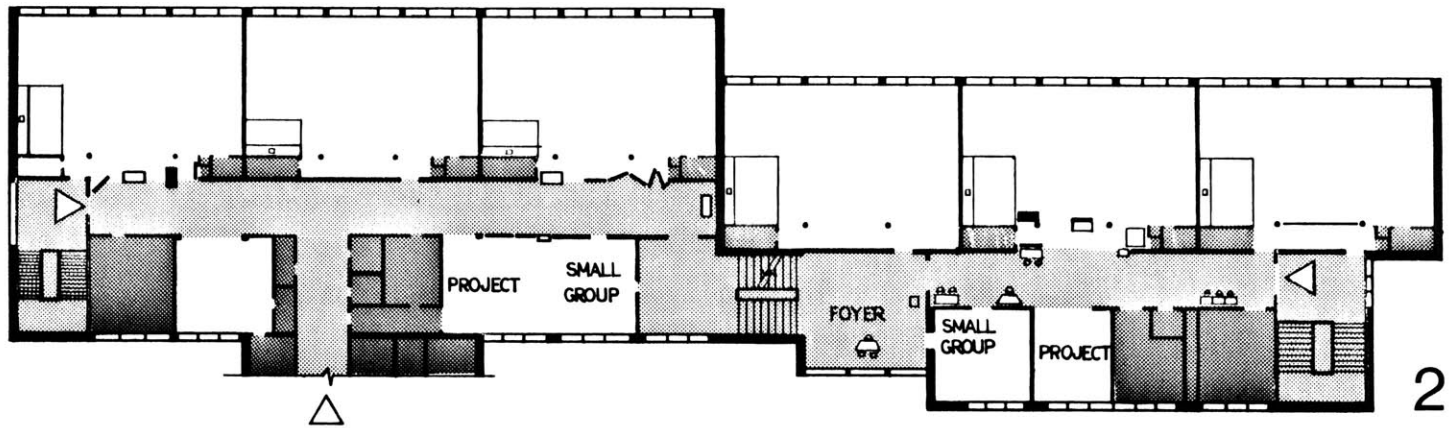


DEVOTION



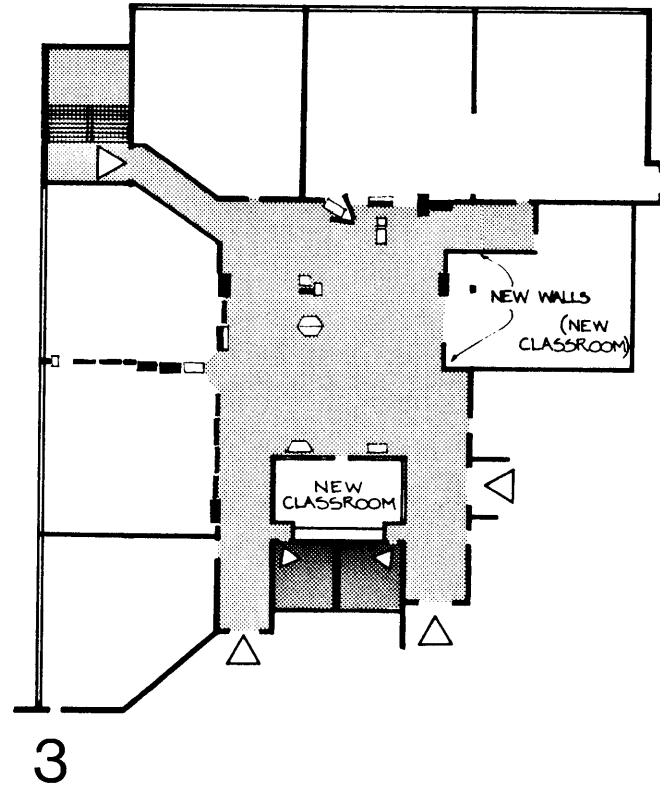
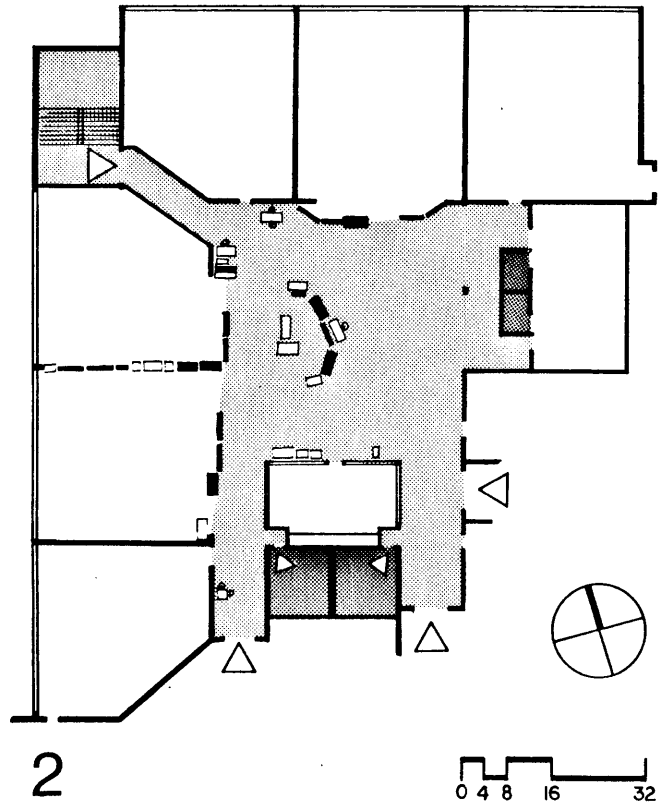
In the renovated wing, for the four lower levels, the old corridor serves as circulation. One side of half the classrooms can be, or are, open to the corridor (some have folding partitions). The other classrooms are closed to the circulation by fixed walls. Amount of traffic differs greatly on each level depending on whether it is a "dead end" level or a "way through" level, and so these classes open to the path responded in different ways. Those at the entry nodes to the wing are closed off to the traffic, whereas other rooms tend to remain open. Also, where there is little traffic, and enough room, the hallways and foyers have some furniture in them at which work can be done separately from the class.

Designers of the Devotion school built in folding partitions so that like Pierce, there is no question as to where the classes locate themselves. In both new and renovated wings, they separate class areas. In the 1952 wing, the lower four levels hold fourteen classrooms, ten of which can be completely enclosed. In fact seven were at the time of observation. At the two ground levels (eight classes) either it was obvious from the location of the furniture that the walls between classes rarely moved, or teachers said so. On the middle two levels (six classes, same amount of space) the teachers indicated the walls were moved for group events.



Access to each of the two levels in the Devotion school's new wing can be gained by any one of four entries (one is a fire stair). Given an open shared area with classrooms around it these entries generate a loop shaped pattern of circulation. Unfortunately because of the lack of spatial differentiation between loop and shared area, pathways cut across the center, no doubt contributing to its apparent underutilization. On the other side of the loop however, all teachers had heavily built up boundary lines with furniture where there were no walls (75% of the linear distance had been "completed").

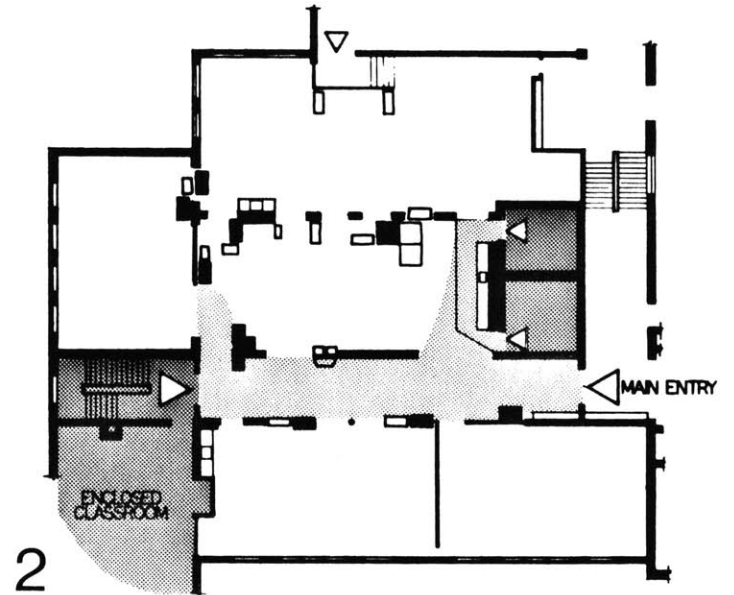
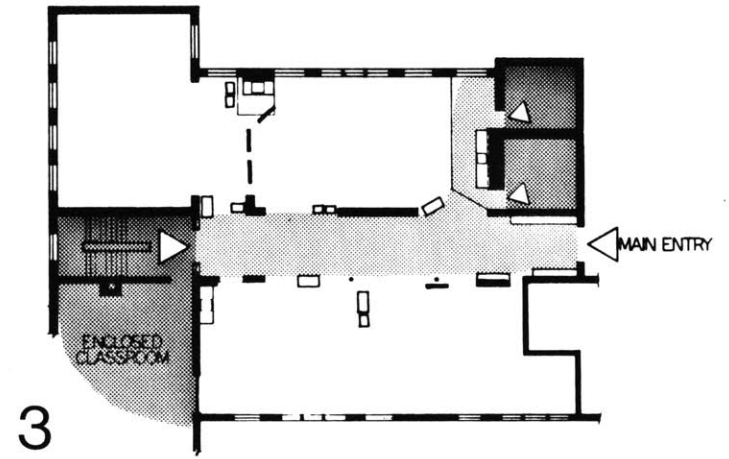
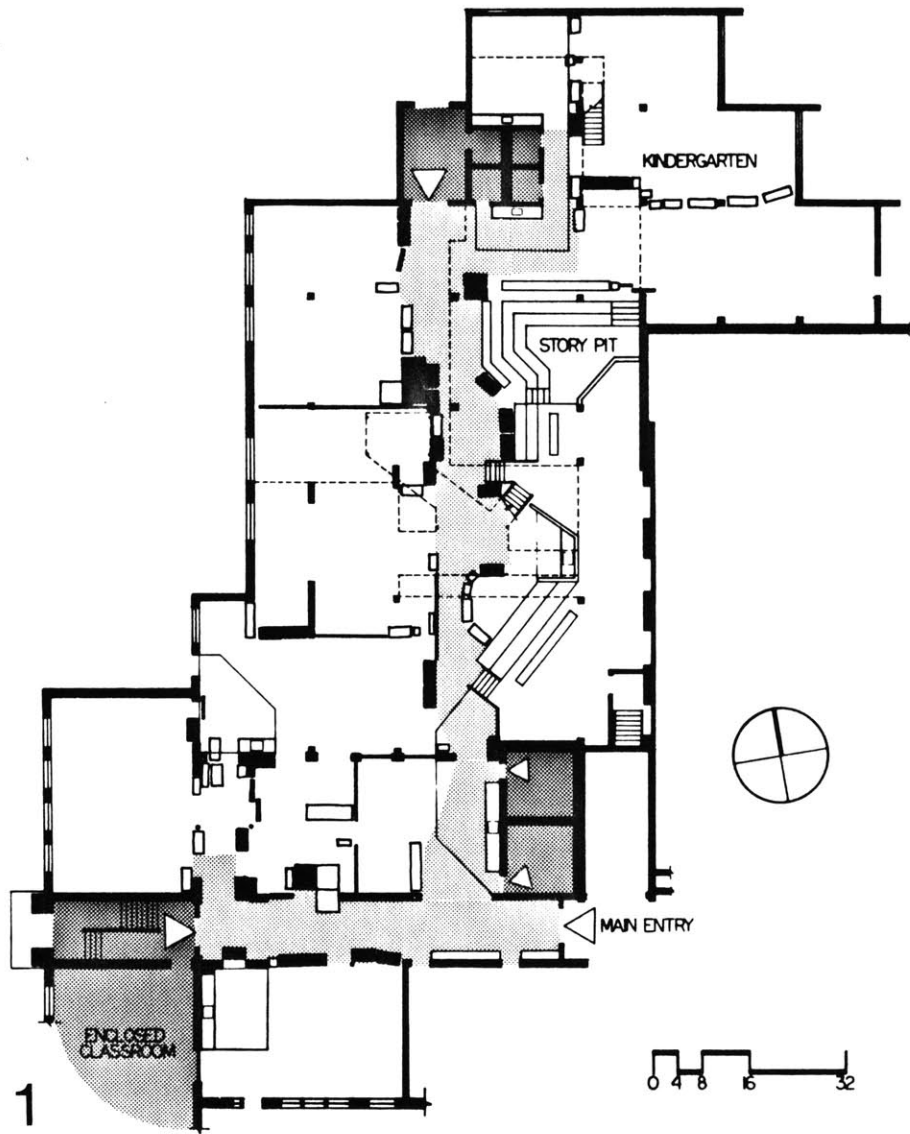
Only one half of one wall (out of six) was observed open. Teachers' comments and other evidence (materials pinned up over the joints between leaves, and furniture up against them) indicated that the rest rarely moved. As a result, five out of six classrooms in this wing that could be completely closed, were. In the renovated



LAWRENCE

Again, as elsewhere, where the amount of traffic was large, users in the Lawrence school had heavily defined the separation between their space and the path. On the upper two levels the circulation follows the old corridors, while on the ground floor part of the path turns and runs down the middle of the addition. In the old part of the building existing walls were extended by furniture and some permanent partitions replacing those which had been torn down in order to regain closure to the pathway. The new pathway also had large amounts of partitioning and furniture isolating it. In general, length of openness to the pathway was reduced by 64% more so on the lower level than above.

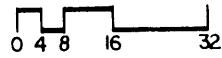
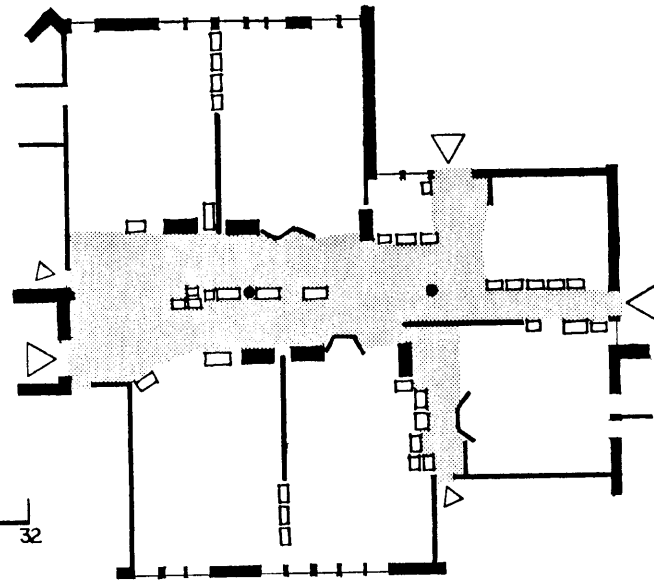
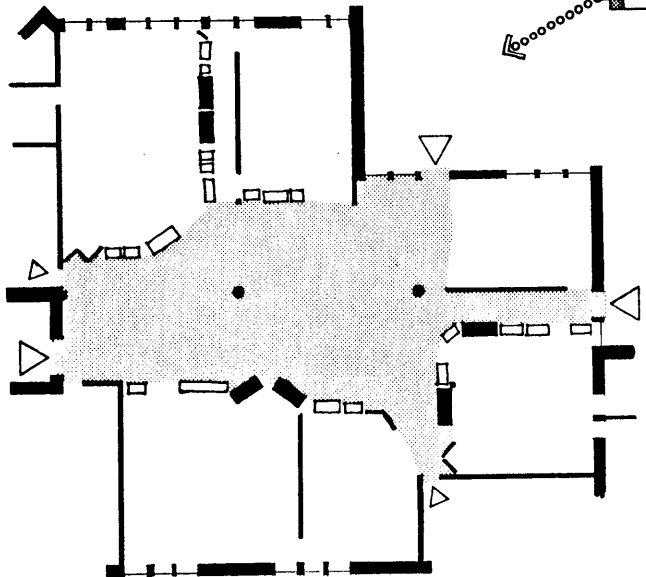
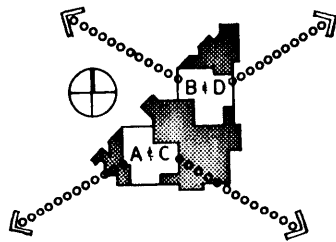
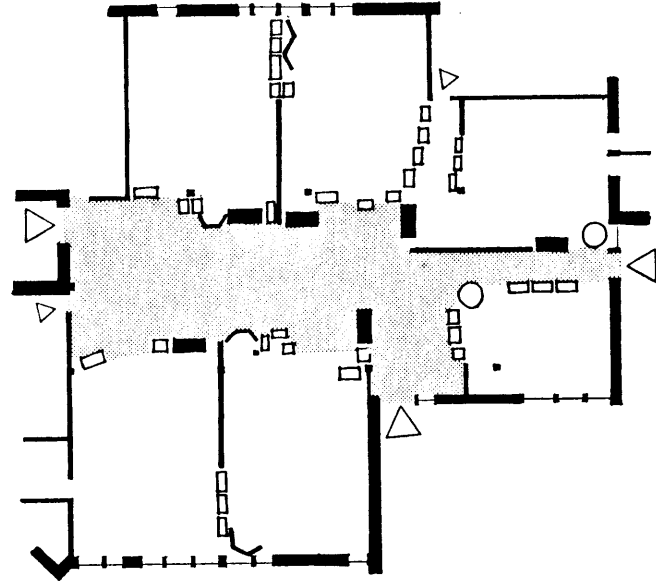
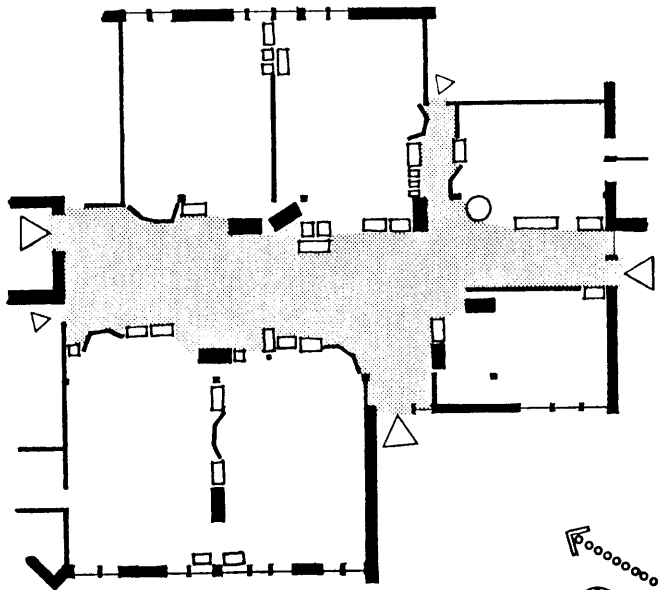
In the renovated parts of the Lawrence school, existing bearing piers define class spaces just as they had when it had been an enclosed building. In the new addition, partitions had been erected once class locations became established. Furniture too has been used to reduce connections further. All told, 78% of the length of the boundaries between classes that were open, have been furnished. It is a much higher percentage on the lower level (96%) where the younger children are.



QUINCY

Each sub-school at Quincy has three major entry points (and other minor ones) that inevitably define circulation paths. These paths take up much of the available space, up to one third in sub-school A. In only one sub-school was there any evidence of this space being used for other activities. The arrangement of the doorways at the end of the sub-school away from the center of the building unfailingly generate twenty foot (or more) wide pathways. At the other end, where the area is much narrower, the class areas on either side typically thin the path down to five feet, defined on one side by a new wall. It seems the widest dimension of ninety feet for the sub-school is too great, while the thinner end at fifty feet may be too small. The paths have helped create some class areas as small as 500 square feet while other areas were up to twice that size. In all areas, there is heavy use of furniture to define circulation boundaries that reduce the length of the openness by 76%. Most teachers voiced dissatisfaction with the openness and some furniture arrangements within boundaries clearly show the tendency of shrinking away from the traffic to increase the distance from work area to distraction.

Walls that were put in upon teachers' request before occupying the building, determine class location and



reduce the openness between classes by over 50%. Further, use of furniture has completed these common borders to 94% of their length.

CONCLUSIONS

Open planning proponents have been known to argue otherwise, but it is clear that architects must acknowledge circulation. The examples consistently show that these pathways are predictable given the entry locations and the necessary destinations. It cannot be argued then that for the sake of flexibility, pathways should not be defined. Spaces can be used more purposefully when they are distinguished from the circulation. The shared areas in the new wing of the Devotion school are a good example of this problem.

A pattern appears to emerge of increased replacement of the walls the more class areas lie along the path and therefore, the more travelled it is. This correlation is most clearly seen in the Devotion old wing, and the Lawrence school. It may be that child age and type of program have an effect also, but the number of disturbances likely to occur from groups passing seems to be a stronger variable.

There seems to be no need for the amount of openness between class areas that was left in these schools. The

teachers consistently used all the "stuff" they could get their hands on to bound their domain. And when there wasn't enough, they occasionally requested that walls be built. If one accepts the argument against the flexibility of the undefined open space, then the need for openness is reduced to that of ease of access. In that case, an open door may be sufficient, and flexible too since it offers options.

The need to enclose a class area goes beyond the issue of creating privacy. Teachers often expressed the need to contain children of this age. Having a responsibility for the child makes it important for teachers to keep track of their students. The more open the educational program is, the more this can be a problem. The teacher, by focussing her attention on small groups or individuals at any one time, is less aware of what the others are doing. By containing the children to some extent, they were able to oversee their charges more easily without paying strict attention.

DESIGNING THE LEARNING ENVIRONMENT

? INSTITUTIONAL
LEARNING ENVIRONMENT

If the school designer was concerned with an authoritarian teaching method in which the only thing that happened was teachers lecturing students, then a single room would adequately fulfill the privacy needs of this event. But no elementary school class behaves exclusively in this manner, and it appears there is a continuing movement away from such methods. Out of this movement came the open plan which unfortunately substituted one singular type of space for the other. The problems of the open plan point up its inappropriateness as a solution. A better translation of new teaching methods into physical design would be to look at the range of different activities going on within the class, often at once. From this it would be determined that a similar range of privacy in the built environment is necessary, just as there should be a range of work areas, surfaces, etc. Openness in education means options and variety; the

" Ultimately, a child's ability to develop optimally by performing productively and non-disruptively is affected by a) the amount and variety of things there are to do, b) the variety of places there are in which to do them, and c) the organization and accessibility of those things and places within the classroom space." (Olds)

" The form of the room should be deduced from the mode of teaching." (Loudon, 1839)

built rejoinder must then be spatially varied, not spatially open.

" Properly viewed, an open facility is a space that breathes. Its elastic properties allow choice and variety, including enclosure to the degree desired. Its subspaces can maintain a deliberate degree of contact and interaction with the rest of the school. They have intimacy and they have vista... This is an openness that is not insistent. It is an openness with option." (Propst)

It should be possible to create a range of private spaces in the learning environment without losing the benefits discovered by the open plan. It appears that the classroom need not be that open to maintain the freedom of movement and the cooperation. In fact a good amount of built enclosure, definition, is helpful in making a successful classroom.

The preceding has been an attempt to make a case for a change in the way we design the classroom. In summary it had been argued that:

- modern teaching methods may be less class-group oriented, but the basic organizing block of the school remains that group of 25 students responsible to one teacher.

- these modern teaching methods have certain behavioral implications that openness has not succeeded in addressing.

- privacy is an important need of a child's development and of the learning process as now generally practiced.

- reasons of cost and adaptability are not valid justifications for building open-plan schools.

- manipulable and varied environments are important.

- the sense of community the open plan engenders among teachers and students is an important asset.
- major circulation should be separate from any open learning areas.
- any class area of shared space should be architecturally defined if it is to be useful, and some separation between class areas is desirable.

Based on this information, certain alternative ways of organizing a school's instructional areas seem appropriate. The class unit should have an identifiable base spatially autonomous and large enough for group activities. Yet interaction should be fostered by connections to shared areas and other classes. Circulation may be dealt with by either having the option of closing off the path completely or by creating a hierarchy of circulation. After a certain critical mass of classes using the path is reached, the learning area and path are segregated.

A school building should offer initial options to teachers in terms of the type of space available for the classroom, since in any group of teachers there will be a variety of teaching styles. Thus class clusters should have a variety of openness. The Brookline schools offer this kind of variety although the classes are not necessarily organized in clusters. The Devotion

" It is fairly easy to construct private corners where small groups or individuals can work. It is difficult to focus the attention of a full class, because of the distraction of other classes, noise, and the interest of the surroundings in the immediate classroom. The biggest problem is finding a space where you can focus the group's attention, and where you can do a noisy activity without disturbing others."
(Cashman School teacher)

OPTIONS

school had the most depth, it offered the greatest amount of choice to its users. It had both open and enclosed classrooms, the option of connecting classrooms, and there were closed small group rooms, and project areas. On the other hand, the Lawrence school did not seem to offer enough options, since the three enclosed classrooms were at a premium. Similarly, at the Quincy school where teachers were generally dissatisfied, closed rooms originally intended for other programs that became available to regular classes were also in great demand.

" Early in their occupancy of open plan buildings, the staffs found that separate closed independent rooms were really the most flexible, since they could be used for almost any purpose without interfering with the activities of other groups." (Yerges)

If a class area abuts the path, then some part of it should be enclosable. An area, shared or otherwise, accomodating activities not that sensitive to distraction can be adjacent to (not in) the path with a small amount of definition in between. But to avoid the responses as seen in the Quincy and Lawrence schools, the actual class territory should be out of view or enclosable.

CLUSTERS

Preferably, the school should be broken down into workable clusters of two and three classes. The rewards of interaction (teacher and student cross stimulation) are quickly counteracted by the penalties of circulation problems and other intrusions, if the clusters are any larger.

With a hierarchy of circulation, major and minor paths, small segments of the population would be exposed to only their own circulation. These would be small enough groups that they would be able to control the amount and timing of movement if needed. The examples here indicate that the critical mass is small; no larger than groups of three classes. The potential for self-regulation quickly deteriorates if larger than three. The Cashman school's pods where there was much cooperation are examples to the contrary, but there is another controlling factor. The mechanics of reaching more than three clustered areas from a central entry off a path are problematic. one can only turn left, right, or go straight ahead, without excessively long paths within the cluster. The Cashman school demonstrates the awkwardness of getting to a fourth space.

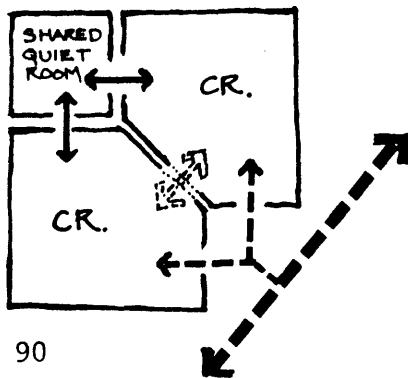
The amount of segregation between the major path and the cluster need not necessarily be a complete acoustical isolation, but certainly should be visually so. The entry onto the cluster could be open and yet arranged in such a way that direct visual connections were screened. This is based on the improvement experienced at the Cashman school with the new walls, which did not acoustically separate the path. Noise can be kept down, but the visual impact of class groups moving past requires a visual screen.

" Controlled circulation can be designed as a transitional experience to diminish antagonisms between environments markedly different in character and tempo. Through pauses and interim diversions, a filtering movement also protects sensitive points within environments from undergoing internal conflicts." (Stevens/McNulty)

It has been suggested that teachers rarely work together in groups of more than two, if they work together at all. Clusters much bigger than this will most likely break down into these smaller groups, and no extra advantages other than cursory interaction will be gained by this larger size.

Australian educators have noted teachers opting for two and three unit spaces rather than the larger clusters.⁽³⁰⁾ Consequently, they recommended two-teacher "pods" that allow autonomy and mixing.⁽⁴⁴⁾ There should be some autonomy for these clusters, and with a small size such as is suggested, this can be a political reality. The smaller the group is the easier mutually beneficial decisions can be made. In order to foster interaction, some facilities should be shared.

SHARED AREAS

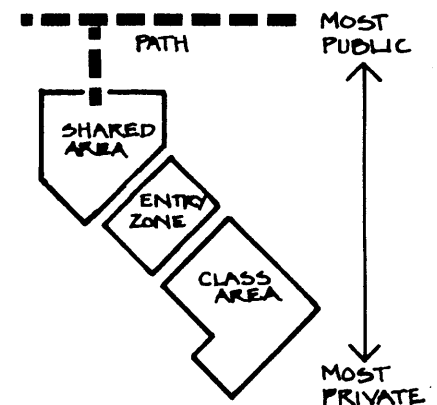
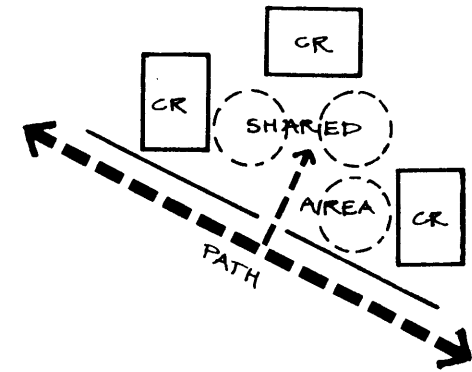
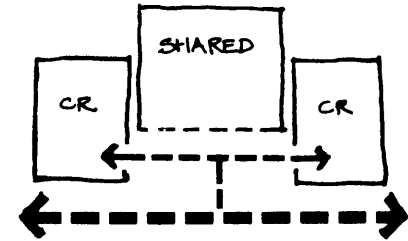


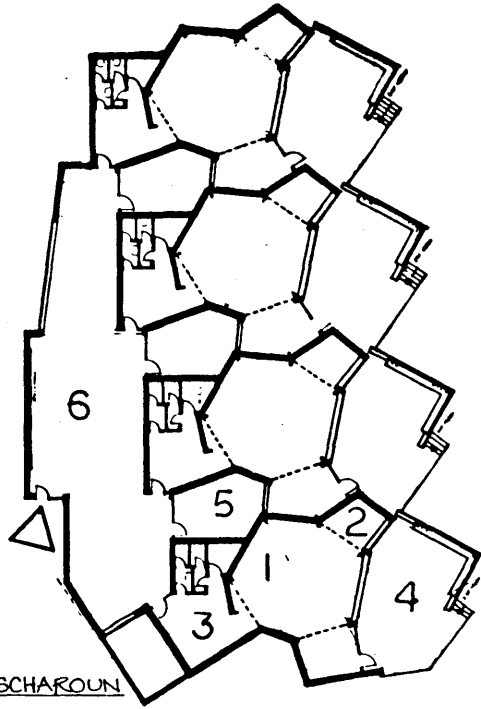
So that shared facilities are used by all, they should have a central location that precludes the spatial domination of it by one group. A shared area might be a very private space or a very public space; quiet or noisy depending on the needs of the users and how they want the space apportioned. Two classes might share a quiet room, maintaining their main space for noisy activities with possibilities left open for connections between classrooms. Or, the shared space might be the focus of the cluster, a shared open area that the

classes open out on, and therefore noisier. Visual connections between each class area and the shared should be possible, but some amount of enclosure between should exist as well as the ability to close off the class area completely acoustically.

A shared area like this runs the risk of becoming too much like circulation as did the new wing of the Devotion school. The problem is simplified with only two class spaces; the shared area gets natural light and is a destination rather than a way through. With three class areas to a cluster, it becomes difficult to keep the shared quality and light in the enclosed spaces. A path should be defined down one side of the shared area, by a level change or some other device. A path down the middle of the shared space and well defined might be preferable. It would divide the shared area into parts strongly associated with each class area and yet still open to the others. This association to the class area would in all likelihood increase the shared areas' use since ownership is established, but contact with students from other class groups would be maintained. It also helps smooth out the transition from most public to most private.

This would be reminiscent of the British "enlarged corridor" model, which "combines some sense of territory with the possibility of interaction."⁽¹³⁾ Basically a





SCHAROUN

School at Marl, 1960-8. Plan of a lower school unit; 1, classroom; 2, annexe; 3, entrance lobby; 4, external teaching space; 5, courtyard; 6, communal space.

take-off from conventional plan schools where innovative teachers started using the corridor as an extension of the classroom. The idea has been institutionalized in new schools where the corridor wall folds up. Hans Scharoun's school is a German example where the corridor is a large group room. ⁽⁴³⁾ The Devotion school's old wing in this study works in the same manner where the traffic in the hall is a minimum, (which should be a requirement of all schools based on this type). If these were more cluster-like however, and less linear, they would offer the same possibilities, and feel like more of a community in themselves. The need of making the child aware of increasing levels of organization is part of the socializing process of school, that Scharoun recognizes. He attempted to build this idea in by clustering well defined classrooms within the school, thus making three levels of community explicit.

CONNECTIONS AND SCREENS

"The filtration concept applies to environments in which there is a need to separate conflicting social and visual patterns or to prevent aggressive intrusion."

(Stevens/McNulty)

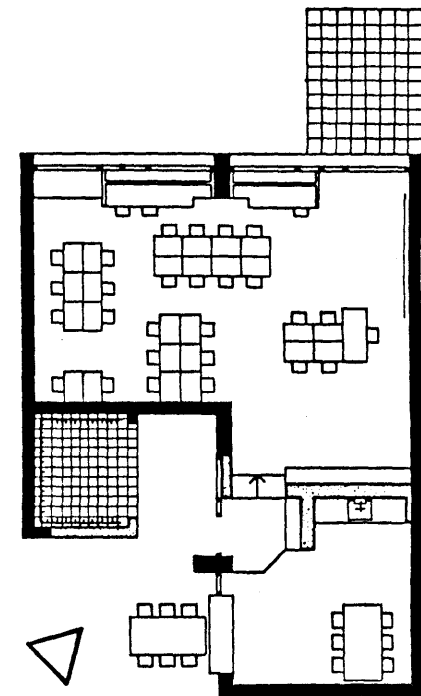
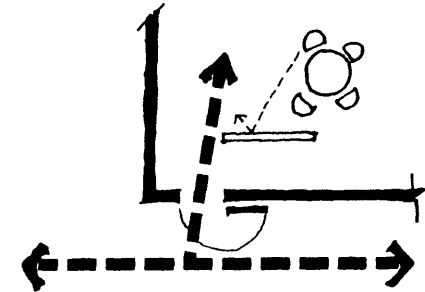
The architect should use doors and glazing in such a way that connects and yet screens. A less expensive substitute for folding partitions which do provide options might be double doors with a window on the side. When open, the connection would still be generous enough yet not take up the whole wall, and it is an easy enough connection to cut off or screen if need be.

The aim of an environment that uses screening and

partial enclosure, is to allow purposeful activity and prevent unwanted intrusion. Screens force a certain level of effort on one person's part in order to interact with another. Through a layering of partial barriers privacy can be maintained, but purposeful interaction is not discouraged.

An example of this was observed at the Devotion school. An enclosed classroom that keeps its door open during parts of the day, but just inside the door is a high partition which prevents seeing in or out. The open door allows access to others who have business in the classroom, but prevents corridor activity from becoming a visual distraction. The ease with which others enter the classroom would be radically altered if there was no screen and the door closed. Similarly, if a closed room provides a supervision problem for a teacher outside it, whose students may be inside, then a glass panel may be a solution. If the glass circumvents the desired visual privacy then screening at some distance from the glass will allow the teacher's purposeful checking up on the students while not disturbing them, and still keep most undesirable visual distractions out.

The Scharoun⁽⁴³⁾ and Hertzberger⁽⁴⁰⁾ examples utilize this layering of space to create a transitional zone at the entry to the classroom in a slightly more generous



HERTZBERGER - MONTESSORI SCHOOL

manner than the Devotion example. The entry then has the potential to be an extension of the classroom, i.e., it may afford a place for an activity center. Most certainly it makes the movement from class to shared area less abrupt and therefore easier. Use of storage areas (coat room) and bathrooms to enclose this zone makes them accessible to students in both areas.

ACTIVITY AND SEPARATION

*" By creating a variety of spaces within a room, each of which is designed for a different function, it becomes possible... to support as many as fifteen or twenty different functions at one time."
(Olds)*

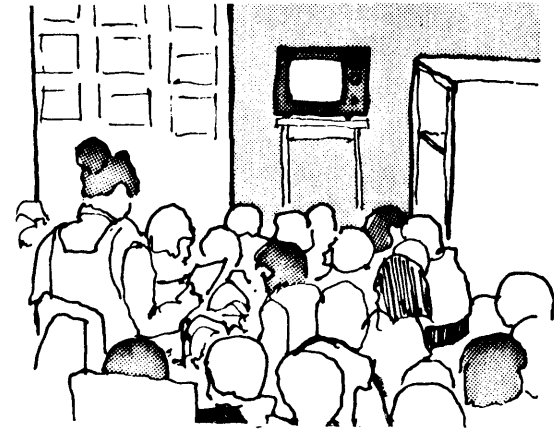
The diverse activities taking place in the modern class, (see Olds⁽⁶⁰⁾ and Sanoff⁽⁶⁸⁾) need to be classified in some behavioral terms in order to determine the amount of enclosure they require when planning for adequate privacy. Two such terms suggest themselves: the degree of "concentration" needed to perform the task, and the amount of "commotion" the task creates. Programmers should measure activities according to these two "dimensions" in addition to other needs, and calculate the needed privacy from there. Both those that require a high amount of concentration and those that cause a great deal of commotion, require a high level of privacy. Little privacy is needed for those that require little concentration or make little commotion. Of course, those that make little commotion are very often, though not always, the activities that require much concentration.

In addition to this stratification, the size of the group

participating in the activity is important. For example, of the twenty or so activities that Sanoff lists for programming learning environments, ⁽⁶⁸⁾ several typically take place in large groups: use of visual aids, listening/story telling, music, indoor active play/movement, dramatics, clean-up. Many of these are the things teachers felt inhibited in doing in open space, not because they require concentration, but because of the commotion they generate. For these the group needs privacy, either in a shared enclosed area or in its own space.

Other activities, and some of the above activities too, occur in small groups or are performed by individuals. Consequently they usually take place at the same time since resources are limited. Because each one's spatial needs are small it would be inappropriate for the building to define each one. It is enough to separate them according to privacy needs.

It appears from this that in addition to group privacy needs, which will be separate over time, high commotion and high concentration activities need separate private spaces. Within quiet and noisy areas, separations by screens and furniture would seem adequate, but between them, a maximum of separation, if not the potential for acoustical isolation, would be desirable. Since high



HIGH CONCENTRATION:

Reading
Writing
Concept Formation
Manipulative Play
Math
Napping

HIGH COMMOTION:

Art
Music
Drama
Construction
Blocks
Water Play
Active Play
Audio-visual Aids

OTHER:

Science
Cooking
Eating
Clean-up
Locker and Cubby

ALLOCATION OF SPACE

commotion activities often require large amounts of space and special facilities (sinks and storage), more so than high concentration activities, probably the best way in which to organize these spaces is with the group space doubling as the noisy activity area.

At the level of the "class," the designer has several choices as to the allocation of space. In Massachusetts, state subsidies for school building construction have inevitably brought about the creation of standards regulating classroom size. For the elementary school level they are 900 to 1000 square feet,⁽⁵⁵⁾ which based an average class size of twenty-five students results in 36 to 40 square feet per student. This minimum to maximum range can be exceeded by communities that have the extra money, but such standards once established quickly become the norm. As such they are a useful reference point.

We should keep in mind that in a teacher-directed situation where desks face a blackboard, each student's desk requires approximately 20 square feet, or only 55% of the minimum Massachusetts allotment. That 500 square feet (20 s.f. by 25 students) represents the largest chunk of area that necessarily needs to remain intact; and only if teachers using the "chalk and talk" methods need to be accommodated.

Current practice has been to take the 900-1000 square foot classroom and either line several up along a corridor or to build up an open space as a conglomeration of these spaces. In fact open-plan schools are often designed with the possibility of converting to enclosed classrooms (e.g., the Quincy school) usually a self-fulfilling prophecy. Thus the classroom area allotment has been inviolable; it is rarely divided up into more than one space.

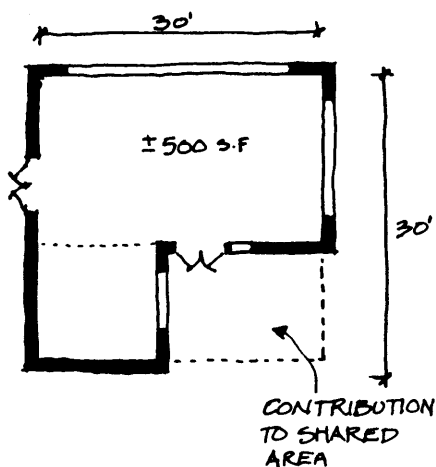
Of the examples in this study, both the Cashman and Quincy schools contain the minimum of 900 square feet per class in the pod/sub-school areas. (The difference being that the Quincy allows 15% for circulation within the sub-school; the Cashman does not, now that walls have separated out the major routes.) Of the Brookline schools, the older wing of the Devotion school has ample space in the classrooms alone (+ 1100 s.f.) not counting ancilliary spaces (project areas, group rooms). Rooms in the new wing contain the minimum, shared areas are extra. The Pierce school wing is based on modules of + 780 s.f., slightly less than minimum, the shared project areas making up more than the difference. The Lawrence school's base area were also generally slightly less than minimum, not counting shared areas.

*" Why is it people feel that because it's open space, classrooms can be smaller than usual?"
(Cashman School teacher)*

The interesting problem is to take the "worst case,"

the most economical, of 900 square feet, which allows no extras for the architect to play with, and try to create more privacy possibilities. Two strategies, shaping the area and/or allotting the area between different spaces, are possible avenues.

see Hertzberger e.g. pg. 93



'DIAGRAM' OF POSSIBLE SPACE ALLOCATION 900 S.F.

For the classroom enclosure, the "L" shaped room with unequal wings, is a usual method of creating spatial variety and offering potentials for privacy. The corners of such a room suggest many more different possibilities for enclosure, and therefore group size, over a simple rectangle. The more traditional teacher can be appeased by leaving one leg of the "L" as big as 500 s.f.

The extreme in dividing up space into many activity areas, called the "nook and cranny" model by some,⁽⁹⁴⁾ has been used by the British. They eliminate the idea of a classroom. "It is no longer a matter of designing for classes of a given size, each occupying a separate room and following a clearly defined programme. Such an approach immediately limits the choices available to the separate classes, except at enormous costs."⁽⁶³⁾

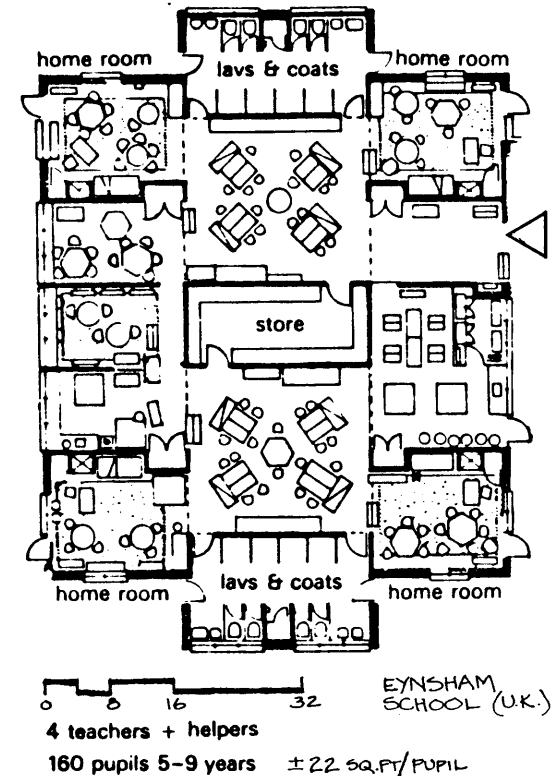
This takes the attitude that very rarely will all the students be in the same space at the same time, so that no space need be very large. It may be that these schools go too far in the opposite direction from singu-

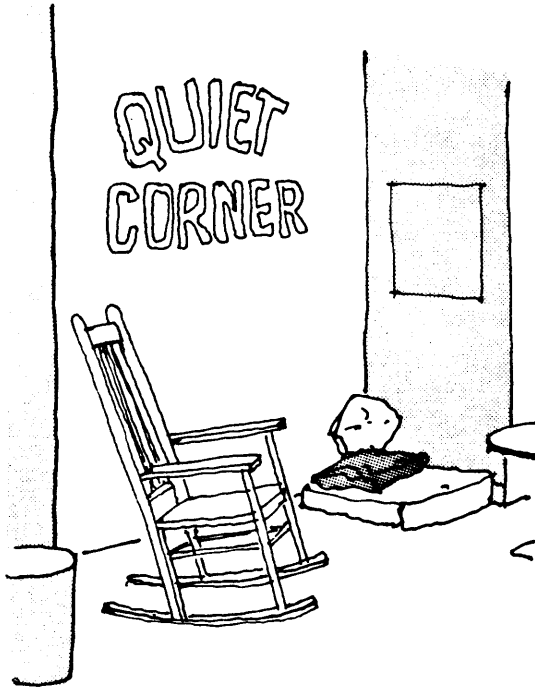
lar spaces. In fact they have been criticized because the class territory is not well defined in the sense that it is hard to read where one class space stops and another begins. The younger children lose the sense of their group within the larger community, making for a more bewildering experience.

This supports the argument that the ability to cope with the large community increases with age, and that very young children should be in more well-defined groups, becoming less so as they get older. Evans goes on to say that some of these schools "cannot be operated effectively without some kind of team teaching situation," which teachers and children may not want. "... children have not scattered as much as was intended. They have tended to stay near their own teacher." And finally, the excessive fracturing of space increases the organizing work-load of the teacher who has more ground to cover for checking up, finding students, etc. (42)

These three criticisms simply underscore the need for the architecture to recognize the class as the basic organizational element.

If the class unit is well defined spatially the children will be able to identify with it more easily. Similarly, more spatial autonomy for the class away from the





cluster maintains the option for the class to operate on its own and does not enforce teaming. And if more of the fracturing of the space is left up to manipulable definition and sub-spaces are only suggested by the architecture, then options are kept open. Teachers then decide on how fractured the space gets, and visual connections between sub-spaces can be maintained if necessary by the use of lower screens (which still give some privacy).

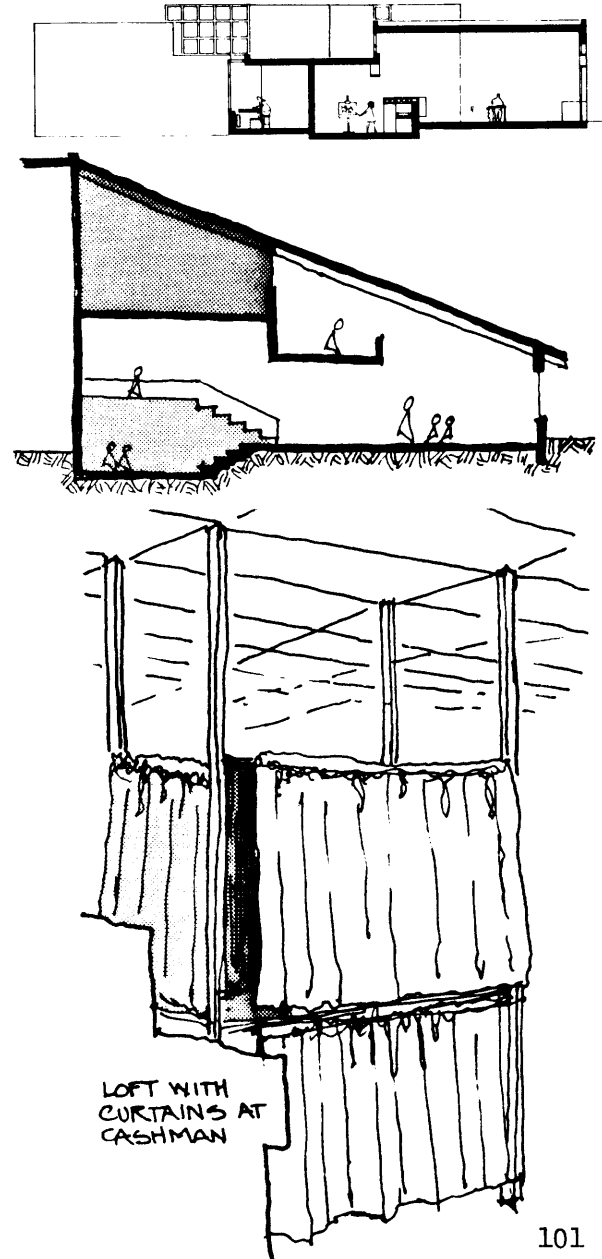
Recent Australian models of open schools use a variety of well defined spaces. In addition to shared project areas, each class areas has a small quiet room (+ 100 square feet), and clusters of classrooms have a "withdrawal" room for noisy or quiet group activities.⁽⁴⁾ The clusters are larger than recommended here, and in fact Australian educators have acknowledged they are too big.⁽⁴⁴⁾

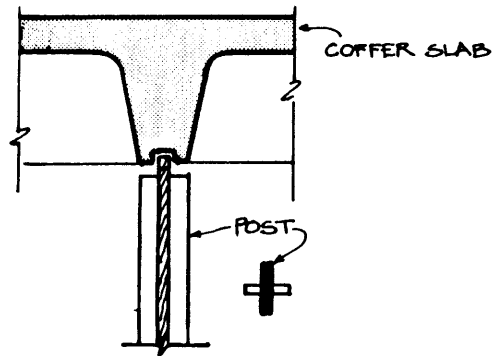
The British government's own evaluation⁽⁶⁸⁾ of the "nook and cranny" school acknowledges the importance of the home base, and that "the first priority in shared spaces is for quiet withdrawal areas provided on a generous enough scale to make withdrawal a workable reality." It must therefore be big enough for the whole group (Eynsham school's⁽⁶³⁾ home base/withdrawal areas are clearly

too small at approximately 210 square feet for 40 children!)

The Hertzberger example takes advantage of the privacy possibilities that level changes within the class space provide. Few school buildings exploit this, but varying the vertical dimension (both floor and ceiling) is a common way of creating the sense of a more or less private space, because it changes the distance of the enclosure. The difficulty the systems built schools have in varying ceiling height is one reason why the resulting spaces are so uninteresting. Scharoun also change height between larger and smaller spaces, and uses the opportunity for clerestories that increase the natural light. The Lawrence school's first level is the only area of the examples in which height varies in the class area. Mezzanine levels, the sloping roof and a raised floor all help to change the enclosure. It suggests to the user many ways of arranging the environment, rather than not suggesting anything.

Height can be used in other ways to create privacy at a smaller scale. Many classes had loft structures that offered many possibilities. Above or below, the intimacy of the places made this way was very popular with the students. Ceilings that can be reached and used are much more useful than high ceilings like those at the Pierce





POST SYSTEM AT FAYERWEATHER
SIMILAR AT CASHMAN.

school. If this surface can be attached to in some way, teachers and students have another way in which to articulate their environment. In addition to being able to hang materials from it, a useable ceiling simplifies the user's efforts to subdivide space. This was the case in the Cashman and Fayerweather schools where teachers, with consultants, had developed a system of interchangeable pieces whose supporting posts got their stability from the channel in the "coffer" ceiling system. Tabs in the ends of the posts fit into these slots, and a variety of screens and surfaces (tables, lofts, storage pieces) could be attached. Although the ceiling could not be nailed into, this small reveal had rendered both concrete and partial ceilings useable.

This points out more small-scale issues not dealt with here, but that need some attention. Many teachers disliked the standard furniture they had to work with. The system mentioned above was versatile and easy to change. It seems that the architect and educator should begin to pay attention to possibilities like these rather than simply relying on what is available. While the screens and rolling storage components were useful, they were limited. In fact lack of enough storage and wall display space were universal complaints despite the numerous bookcases, screens, tote-tray holders and cabinets all

on wheels, that all the classrooms had. So even at this level the want for added definition is very real.

Classroom activities now-a-days take place at such a small scale that architects tend to be unaware of their implications, focussing on larger levels of enclosure. But the design of a setting for these activities must be supportive, and the architect is responsible. The worse the fit between the built environment and the activities within, the more energy is put into physically and psychologically adapting. The loss of that energy which might have been put into the task at hand is probably particularly counter-productive in the learning environment.

"...there is no such thing as the design of space. Behavior, not space, is enclosed by architecture. No dwelling, building or city is planned to be empty. In order for the planner or architect to know the purpose of his design, he must know thoroughly the behavior he will enclose." (Bechtel)

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