R E P O R T R E S U M E S

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THE EFFECT OF WINDOWLESS CLASSROOMS ON ELEMENTARY SCHOOL CHILDREN.

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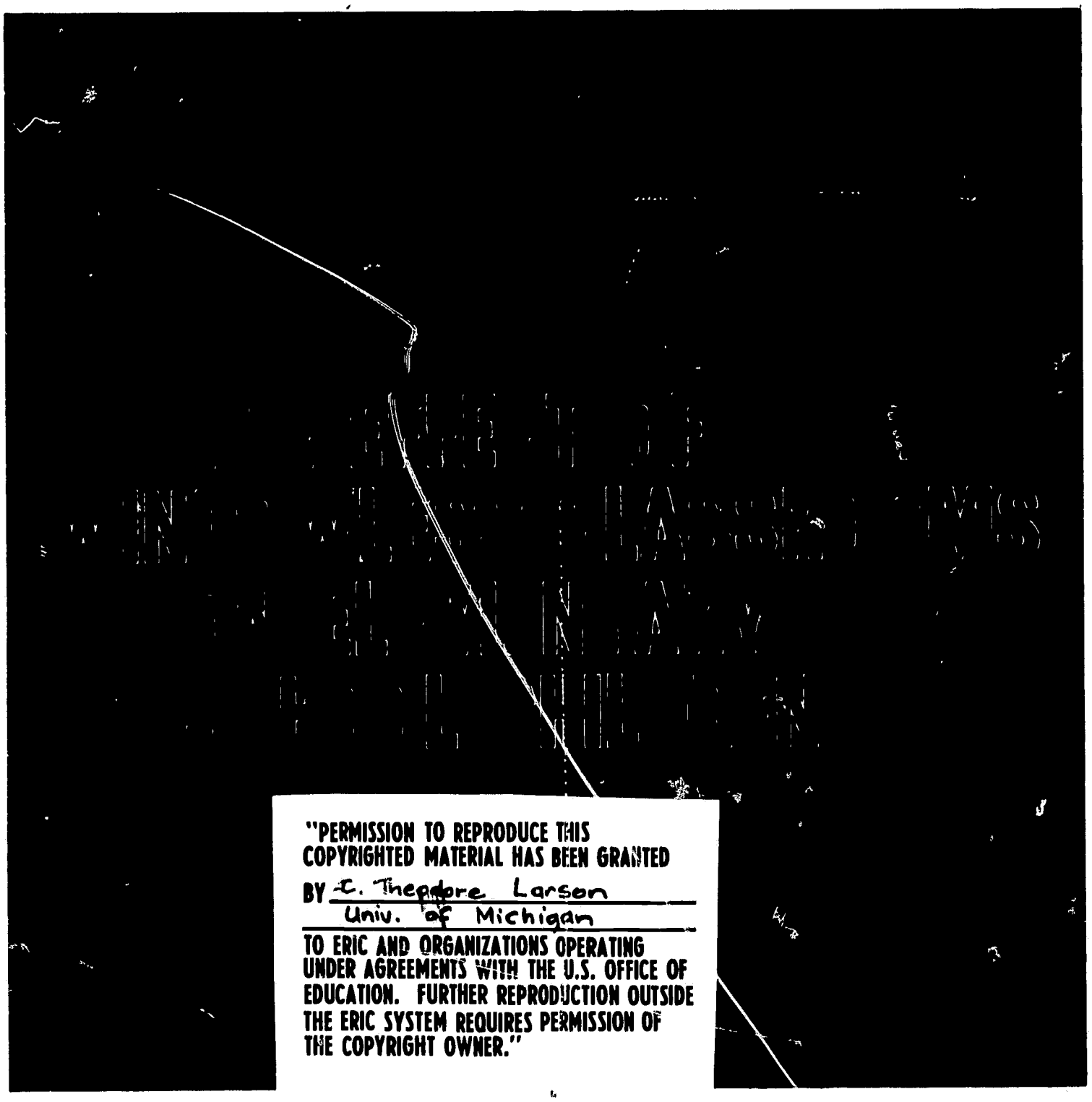
MICHIGAN UNIV., ANN ARBOR, COLL.OF ARCHITEC. DESIGN

PUB DATE NOV 65

EDRS PRICE MF-$0.50 HC-$4.12 101P.

DESCRIPTORS- *ENVIRONMENT, *ENVIRONMENTAL INFLUENCES, *LIGHTING, *SCHOOL DESIGN, *SCHOOL ENVIRONMENT, CLASSROOM ENVIRONMENT, MICHIGAN

THIS CASE STUDY WAS MADE TO DETERMINE THE EFFECTS OF NONFENESTRATED CLASSROOMS ON CHILDREN'S LEARNING ACHIEVEMENT. USING GRADES K-3, OBSERVATIONS WERE MADE IN TWO SCHOOLS OF SIMILAR CONSTRUCTION AND DEMOGRAPHY. THE STUDY WAS MADE IN THREE SETTINGS--A YEAR IN EXISTING FENESTRATED CLASSROOMS, A YEAR WITH ALL WINDOWS REMOVED IN THE TEST SCHOOL AND ONE-HALF YEAR WITH THE WINDOWS RESTORED IN THE CONTROL SCHOOL. DATA DERIVED FROM RECORDS ON LEARNING ACHIEVEMENT AND CHILD BEHAVIOR DURING THE STUDY SHOW A CLOSE PARALLEL IN PUPIL LEARNING ACHIEVEMENTS BETWEEN THE TWO SCHOOLS AND THAT WINDOWS HAVE LITTLE EFFECT ON THE CHILD'S ABILITY TO LEARN AS REFLECTED BY HIS LEARNING ACHIEVEMENTS. DATA WERE ALSO KEPT ON ABENTEEISM. A QUESTIONNAIRE TO SAMPLE THE REACTIONS OF CHILDREN AND TEACHERS SHOWED GENERAL APPROVAL OF WINDOWLESS CLASSROOMS BY TEACHERS STATING THAT THE ROOMS HAD FEWER DISTRACTIONS FROM OUTSIDE NOISES AND WEATHER CHANGES, A FEW TEACHERS COMPLAINED ABOUT STUFFINESS AND DRAFTINESS IN THE ROOMS. PARENTS' REACTIONS WERE REPORTED BY TEACHERS, MINOR RESISTANCE TO THE STUDY WAS ENCOUNTERED, THE CROSS SECTION OF PARENT ATTITUDE RAN FROM CURIOSITY TO INDIFFERENCE. THE CHILDREN SURVEYED SHOWED COMPARABLE ATTITUDES. ADEQUATE ARTIFICAL LIGHTING AND MECHANICAL VENTILATING SYSTEMS WHICH CONDITION THE AIR TO DESIRED WARMTH AND FRESHNESS ARE ARCHITECTURAL REQUISITES. IN BUILDING PLANNING FENESTRATED CLASSROOMS SHOULD BE CONSIDERED ONLY WHEN EDUCATIONAL PURPOSES ARE SERVED AN OUTSIDE VIEW. (GM)



AN ENVIRONMENTAL CASE-STUDY PUBLISHED BY THE ARCHITECTURAL RESEARCH LABORATORY, DEPARTMENT OF ARCHITECTURE, THE UNIVERSITY OF MICHIGAN

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ENVIRONMENTAL CASE-STUDY

Project Sponsor: Educational Facilities Laboratories, Inc., New York, a non-profit organization established by the Ford Foundation in 1958 for the encouragement of research and experimentation and the dissemination of knowledge regarding educational facilities.

THE UNIVERSITY OF MICHIGAN Harlan Hatcher, President
OFFICE OF RESEARCH ADMINISTRATION Robert E. Burroughs, Director
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Library of Congress Catalog Card Number: 66-63436

THE EFFECT OF WINDOWLESS CLASSROOMS ON ELEMENTARY SCHOOL CHILDREN as described in this report is the outgrowth of a larger investigation aimed at determining the effects of environment upon the learning process which has been underway at the Architectural Research Laboratory of The University of Michigan in Ann Arbor since December 1959.

The parent activity, also sponsored by Educational Facilities Laboratories, Inc., a non-profit organization established by the Ford Foundation, and known as the School Environments Research Project (ORA 03553), has resulted in the publication of three earlier reports which are available through Publications Distribution Service, The University of Michigan:

SER 1 ENVIRONMENTAL ABSTRACTS Condensations of some 600 reference documents selected for their significance as pioneering studies of how human behavior is affected by environment.

SER 2 ENVIRONMENTAL EVALUATIONS A series of essays by various members of the SER project staff which summarize and appraise the present state of knowledge concerning environmental relationships.

SER 3 ENVIRONMENTAL ANALYSIS A proposed method for the defining of environmental relationships, for their investigation as specific case-studies, and for the processing of information required in environmental design.

The study of the effect of windowless classrooms on the learning process was begun in early 1962 at the request of Educational Facilities Laboratories, Inc., and has been conducted concurrently with the parent project. It is the first in what hopefully will be a long series of similar environmental case-studies that are needed in order to create an environmental science which can serve as a basis for the more effective design and control of learning environments.

C. Theodore Larson
Professor of Architecture
and Director, SER Project

November 1965

ALL MEMBERS OF the SER Project Staff have had a personal interest in the question of how the absence of windows may affect classroom behavior, but some have been more deeply involved than others in this particular case-study. Those staff members who have been most directly concerned with its conduct and with the analysis of findings and the preparation of this report are marked with an asterisk (*) in the following roll-call of individual responsibilities:

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Robert B. Lytle, Jr., Associate Professor of Architecture
*S. C. A. Paraskevopoulos, Professor of Architecture

ATMOSPHERE AND HEAT

*Joseph R. Akerman, Associate Professor of Mechanical Engineering

LIGHT

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Norman E. Barnett, Associate Research Physicist
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K. Lonberg-Holm, Architectural Researcher and Information Specialist, New York (environmental analysis)

The SER project has also had an advisory committee which includes the following:

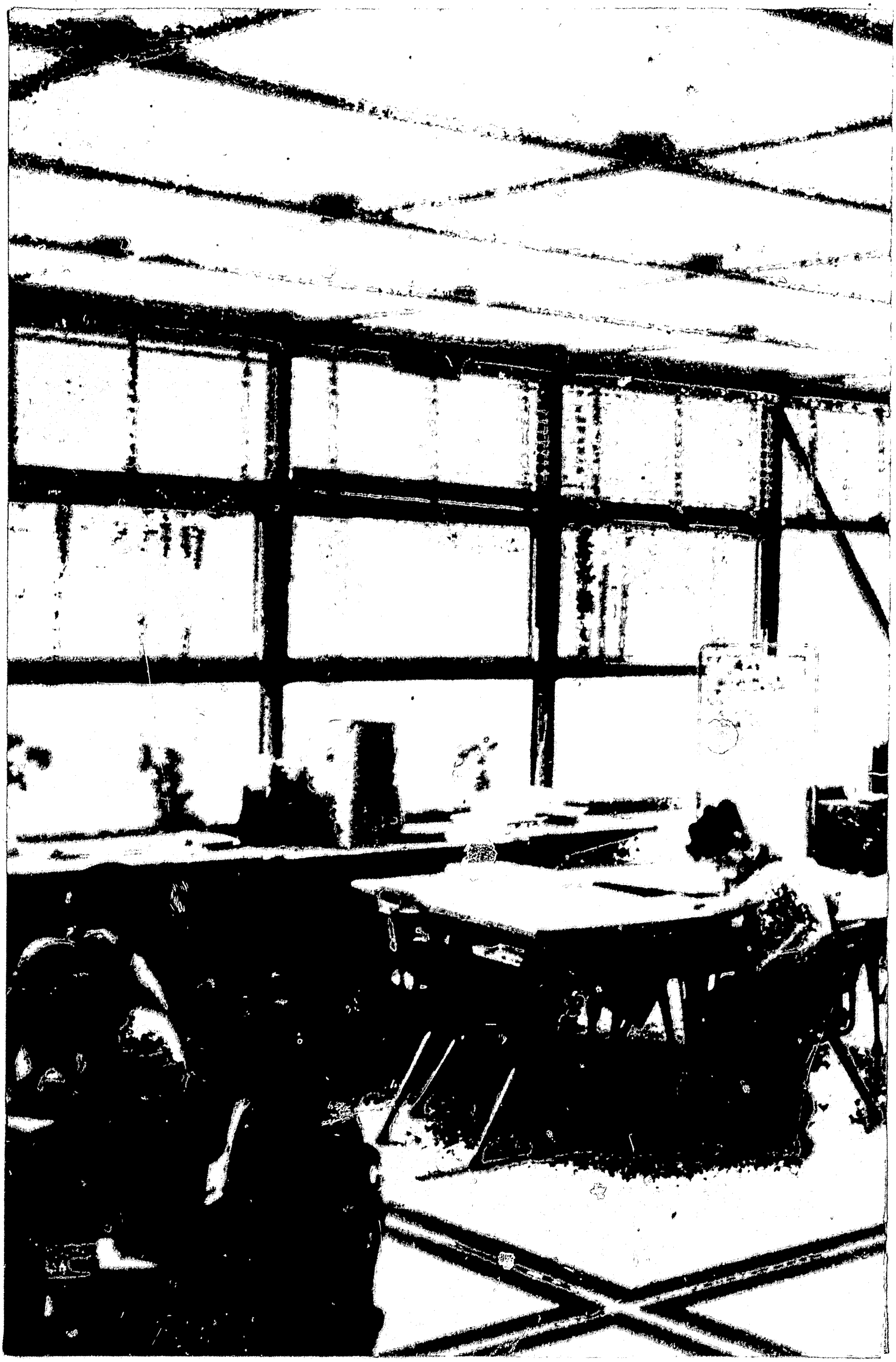
*Willard C. Olson, Dean, School of Education
*Charles F. Lehmann, Associate Dean, School of Education
Howard R. Jones, Professor of Education (now Dean, School of Education, Iowa State University)
Walter B. Sanders, Professor of Architecture
John G. McKevitt, Assistant to Vice-President, Business and Finance
Wilfred F. Clapp, Assistant Superintendent, State Department of Public Instruction, Lansing, Michigan

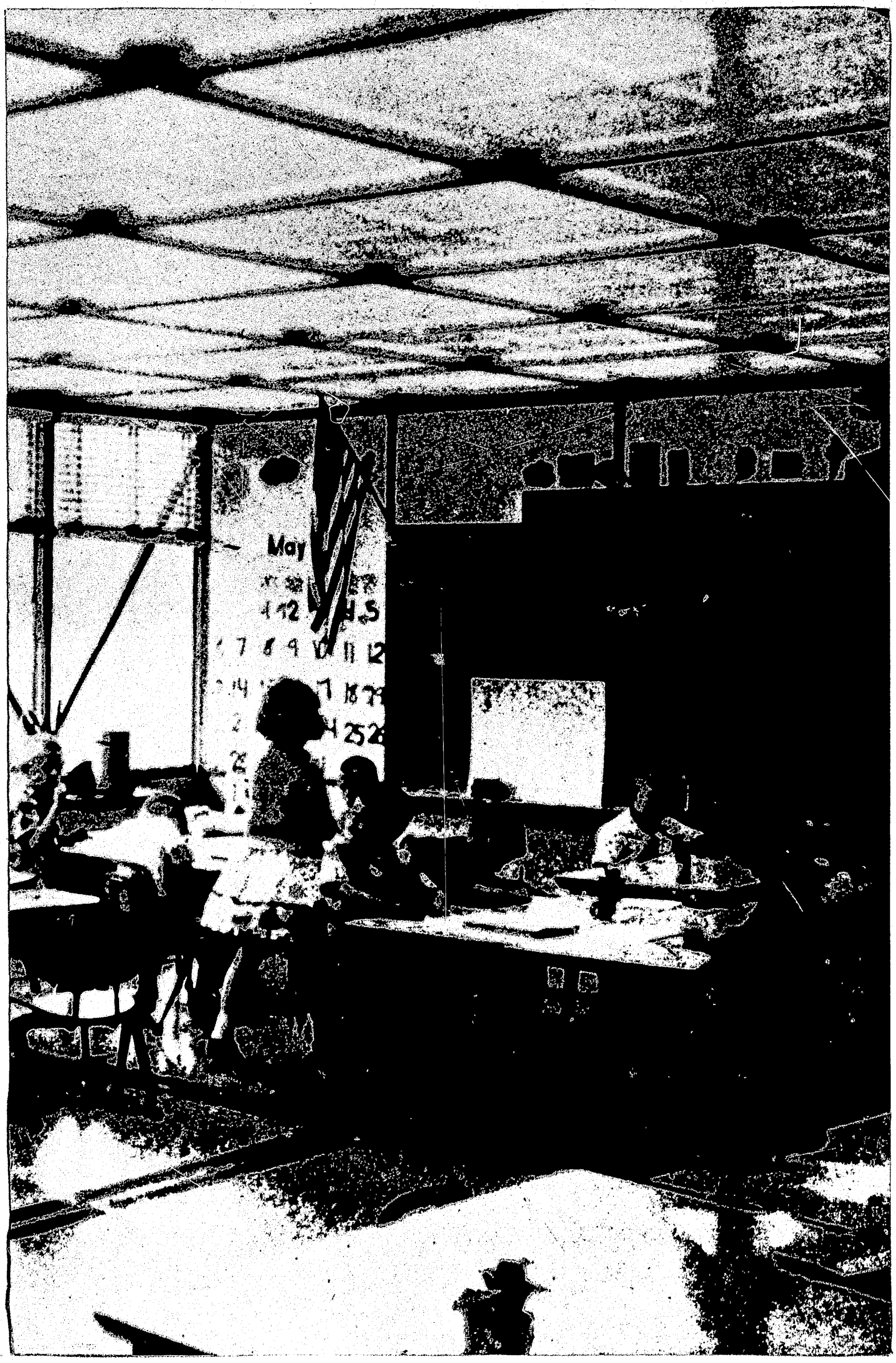
In conducting the windowless classroom case-study the SER project staff has had the warm encouragement and support of the Wayne School Board and the good advice and assistance of various members of the school district administration staff:

P. D. Graham, Superintendent of School (now retired)
Clarence E. Hinchey, the new Superintendent
Harry Howard, Assistant Superintendent of Schools
Mrs. Kathryn S. Muir, Principal, Monroe School
Mrs. Elva Galloway, Principal, Taft School
Mrs. Alice Barnhill, Head Teacher, Hoover School

THE EFFECT OF WINDOWLESS CLASSROOMS ON ELEMENTARY SCHOOL CHILDREN

CONTENTS





1

CASE-STUDY BACKGROUND

OBJECTIVES IN RELATION TO THE SER PROGRAM

Historically, the interest of faculty members at The University of Michigan in the effects of environment on human behavior traces back to 1952 when representatives from architecture and meteorology first began discussing the behavioral implications of man's increasing control of the physical environment. They were soon joined by representatives from the behavioral sciences and other engineering disciplines. Several round-table seminars were held for an informal voluntary exchange of ideas.

It was not until representatives from the University's School of Education came into this interdisciplinary group in 1957, however, that faculty interest in environmental effects took a directional focus. Application was made to Educational Facilities Laboratories, Inc., for a research grant. Upon its approval in December 1959 work began immediately on what has since become known as the School Environments Research Project (ORA 03553).

The immediate tasks confronting the SER project staff were defined as the following:

1. Collection and evaluation of data on various environmental factors and relationships which have a bearing on human comfort, safety, health, general well-being, learning ability, and efficiency in the learning process.

2. Preparation of a detailed statement of the problem which will progressively clarify the environmental factors and relationships involved and thus serve to make increasingly precise the scope of investigation.

3. Initial formulation of procedures for determining and evaluating the behavioral responses of students to their environments while engaged in specific learning activities.

Task #1 has resulted in the publication by the University's Architectural Research Laboratory of *SER 1: Environmental Abstracts* and *SER 2: Environmental Evaluations*. Task #2 has led to the publication of *SER 3: Environmental Analysis*. It is in response to Task #3 that the windowless classroom case-study has been attempted and this present report prepared.

Besides establishing the three immediate tasks, the SER project staff set forth a long-range goal for its own guidance. To show how to create optimum school environments through the discovery, control and development of environmental relationships which are beneficial for the learning process. To this end it was proposed to develop (a) a methodology for measuring the effect of variations in school environments on specific learning activities, and (b) a laboratory facility for determining experimentally the value of any new school environment that might be conceived.

In subsequent staff discussions the notion of having a separate laboratory facility for environmental experimentation began to be questioned. The psychologists pointed out that such a facility would inevitably have a laboratory atmosphere and thus perhaps give rise to what is known as the "Hawthorne effect,*" i.e., the teachers and youngsters might become so self-conscious as laboratory subjects that they would react in a manner quite different from what would be their natural behavior under more normal circumstances. Far better, the psychologists argued, would be studies of environmental variations that might be carried on in established educational facilities where the behavior of occupants could be readily observed without any undue attention being drawn to the fact.

Project analysis also indicated there should be a series of case-studies that will permit certain environmental relationships to be singled out for observation and study under varying conditions. By contrasting and evaluating the behavioral changes that occur with environmental changes, it should be possible then to determine which environmental conditions

*Haire, Mason, "Industrial Social Psychology," Ch. 29 of the *Handbook of Social Psychology*, Vol. II (Ed.) Garner Lindzey, 1954, Addison-Wesley Publ. Co. Inc. and Roethalinberger, F. and W. J. Dickson. *Management and the Worker*. Cambridge, Mass.: Harvard University Press, 1939.

have the highest educational significance for different types of students engaged in different learning activities. In this manner, through a comparison of the findings from various case-studies, there could ultimately be established a scale of values—an environmental yardstick—that would be useful in pointing the way to the planning and design of more desirable educational facilities.

The case-study described in this report, it should be kept in mind, has been viewed by the SER project staff from the outset as an opportunity to begin the development of such an environmental yardstick. Although aimed at finding out what happens when small school children are taught in windowless classrooms, the investigation was intended primarily to be a testing out of the proposed SER method of environmental evaluation.

CONSIDERATIONS DURING THE PLANNING STAGE

It was just about this time—September 1961—that the attention of school architects and school administrators throughout the United States was drawn to the problem of windowless classrooms. A number of underground structures designed to do double duty as fallout shelters and as elementary schools were being built in New Mexico and elsewhere. The whole concept of fenestration had come into question as the result of advances in air conditioning and artificial illumination. In fact, many air conditioning engineers and lighting specialists were contending that windows are not only an unnecessary building expense but an operational nuisance as well, particularly insofar as they introduce problems of heat transmission and visual glare.

If windows—as EFL officials asked the SER project staff—are no longer needed for reasons of ventilation or daylighting, then are they still desirable for other reasons? An outside view, for instance, was being cited as educationally important by the advocates of classroom windows. No ready answer was forthcoming, for the SER literature review had revealed no factual information was available as to the effects that a deprivation of a view to the outdoors might have on classroom learning activities, only a morass of conflicting assumptions and opinions. It was promptly decided that the first case-study to be undertaken by the SER project staff should therefore be an experiment involving classroom fenestration.

Fortunately, near at hand in the neighboring town of Wayne, there were two small elementary schools—the Hoover School and the Mann School—which could be easily and quickly transformed into windowless structures without becoming architecturally offensive. Known also as the "Unistrut schools" because of their system of construction (see following section),

they serve essentially as "feeder" schools, i.e., they are adjuncts to other larger nearby schools and provide instruction for only the kindergarten and the first three elementary grades. Both schools were made readily available to the SER project staff by the Wayne School District for case-study purposes—one to be used as the test unit, the other as a control unit.

The case-study, it was agreed, should cover the behavioral reactions of both the teachers and the youngsters in the two schools during three distinct periods: (1) a school year in the existing fenestrated classrooms, (2) a full school year with all windows in the Hoover School removed and (3) at least half a school year with the windows in the test unit restored. Although much of the current school year had already passed by, the data believed necessary for the first phase could still be obtained without difficulty, so the windowless stage was scheduled to begin in the fall of 1962.

The third stage, subsequently lengthened to run a full school year, was deemed essential in order to offset any criticism that the case-study had not given proper consideration to the so-called Hawthorne effect—the possibility that the pupils might react as did the factory workers in a classic investigation where productivity increased, even under seemingly adverse environmental conditions simply because they were aware of being under observation and had assumed that they were expected to turn out a larger volume of work. By restoring the school fenestration, the learning achievements of pupils in classrooms with windows could once again be observed and compared with those recorded during the windowless stage. In theory, if there should happen to be a Hawthorne effect in the windowless stage it would be likely to occur also in the next stage. As a constant factor running through the entire case-study, it could then be safely ignored.

Whether the Mann School was needed as a control unit likewise received considerable staff debate. The immediate objective of the case-study was to find out, after the Hoover School children had been deprived of an outside view for one whole school year, if there was any detectable difference in their learning achievements as compared with their previous work in the same building with fenestrated classrooms. The performance of the same youngsters would be compared under two different environmental conditions. Only a single environmental factor—the windows—was being altered, and this was being done only in the Hoover School. To bring in a comparison with the youngsters in the Mann School seemed redundant. It was finally decided, however, that the Mann School should be included in each phase in order to make certain, in the event there

were some detectable differences in the learning achievements of the Hoover School children, that these differences could not be attributed to other causes than the elimination of the classroom windows.

In planning the case-study it was recognized that, although only the effect of schoolhouse fenestration was being investigated, this purely physical factor in itself presented a much larger and compounding set of environmental relationships which would take the study into the realm of social psychology. The idea that the classroom windows might be advantageously eliminated carries with it, like any major innovation in the field of education, all the complicated problems that can be identified as resistance to change. The group dynamics existing between parents and teachers and pupils would have to be reckoned with—just how, it was agreed, was a matter that could be handled only as the case-study proceeded.

THE TEST SCHOOL (HOOVER) AND THE CONTROL SCHOOL (MANN)

The two educational units selected for the case-study comparisons are as similar in size and shape as could have been hoped for. Each has virtually the same neighborhood surroundings, typically those of a working-class suburb in a prosperous industrial metropolis. Each has the same architectural appearance and approximately the same number and type of occupants. Each contains four classrooms and a multi-purpose room, in addition to a teachers room, toilets, and the usual storage closets and utility spaces (see photographs and plan drawings, Appendix A).

Both schools are also by-products of architectural research—another project conducted by the Architectural Research Laboratory during the early 1950's and sponsored by the late Charles W. Attwood, president of the Unistrut Corporation. They were erected—the Hoover School in 1955, the Mann School a year later—as demonstrations of how the space-frame system developed by the research activity could be applied to schoolhouse construction.

Essentially the Unistrut space-frame system consists of only four basic parts—a steel strut used interchangeably on the roof plane or on the ceiling plane or as diagonals in the intervening plenum space, and a plate connector to which the strut ends are connected, plus a simple nut and bolt. The whole assembly goes together very rapidly with power wrenches to form roof structures of varying length and width in increments corresponding to the basic 49-inch square module.

The same space-frame system can also be used to form the floor structure. In the case of the Hoover School, for instance, the entire building rests on small concrete blocks placed on gravel in the excavated area and the resulting underfloor plenum is used as a heat chamber in the building's combination convection and radiant floor heating system (see sectional drawing of Hoover School, Appendix A).

The roof structure is supported by steel studs that can be placed anywhere on the 49-inch modular grid pattern. To these studs standard 48-inch wide enclosing panels—asbestos cement, plywood, or other sheet materials—can be attached with snap-on battens to form 4-inch thick walls and partitions. Where desired, windows can be readily had by substituting transparent panels—usually dark-tinted, glare-reducing plastic sheets.

Both the Hoover School and the Mann School use the roof-ceiling plenum for the lighting system. Some daylight comes into this plenum horizontally through fixed plastic panels under the roof overhang directly above the outer wall perimeter, and is then transmitted vertically through translucent (but not transparent) plastic ceiling panels into the classrooms below. Thus each classroom has a completely luminous ceiling which provides about 4 foot-candles of uniformly distributed daylight when the sun is out, even though it is impossible to see the outdoors through the plastic ceiling panels. Fluorescent tubes in the roof-ceiling plenum constitute the main source of illumination—approximately 35 foot-candles at work level in each room.

Although considered revolutionary at the time they were built,* the two schoolhouses have become accepted parts of the neighborhoods in which they are located. Since their erection, several other school buildings using the same structural system have been built, along with a community recreation pavilion. The Unistrut Corporation's main plant is in Wayne and all the new factory buildings have space-frame roofs and the familiar gray asbestos cement wall panels in combination with dark glare-absorbing plastic window panels.

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*The Architectural Research Laboratory in Ann Arbor was actually the first building to use the Unistrut space-frame system of construction. This structure was described in a cover story that appeared in the July 1955 issue of *Architectural Forum*. More detailed technical information about the system can be found in the two reports issued by the Unistrut research project—*Unistrut Space-Frame System*, by Coy and Legatski, and *Structural Analysis of Unistrut Space Frame Roofs*, by Paul H. Coy. Both reports can be obtained through Publications Distribution Service, The University of Michigan.

The citizens of Wayne now take the Unistrut style of architecture pretty much for granted. They see it all over town. They are even accustomed to seeing changes continuously being made in the various Unistrut buildings, for structural change to meet new conditions of use is one of the advantages inherent in this system of construction. Because of this demountability, it was a simple task to convert the Hoover School into a completely windowless building at relatively low cost.

EARLIER STUDY OF THE TEST SCHOOL

Another reason for selecting the Hoover School for the windowless classroom experiment was the fact that it had already been the subject of another sociometric investigation. The school's first occupants were children who had been housed in an older conventional-type school—a large two-story brown brick structure with individual classrooms on both sides of a long corridor—in the same neighborhood. Just before these youngsters and their teachers were moved into the new building, immediately after being installed, and again four months later, they were interviewed as to their reactions to the contrasting environments afforded by the two buildings.

The findings of this earlier survey are set forth in a chapter* written by Charles F. Lehmann (a member of the SER project's advisory committee) for the *59th Yearbook* (1960) of the National Society for the Study of Education. Nicholas Long, since then a member of the education faculty at The University of Indiana, conducted the three surveys.

The children's immediate response to the new Hoover School was highly favorable, but the teachers were divided in their feelings. As Professor Lehmann explains:

> In the former building each classroom was equipped with movable chairs and tables, books, blackboards, and other materials; and the room was enclosed by four cinderblock walls. When the teacher entered the room and closed the door, she had privacy. She could teach any way she preferred without being concerned lest she might be interfering with other classes . . . .
>
> The new school, however, was designed for a highly flexible program which called for considerable interdependence among the teachers. While the old school's size and design prohibited

*Chapter XII, "Analyzing and Managing the Physical Setting of the Classroom Group," pages 253-267.

> communication between teachers and children, the new school facilitated it. Gone were the cement walls, the privacy of the classroom, and the autonomy of activity. To counteract some of these changes, it was necessary for the teachers to develop a cooperative, cohesive group which would enable them to work out foreseeable problems.

By the time of the third interview, the report continues, all the teachers had swung over to a stated preference for remaining in the new building rather than to return to the old school:

> The open planning and the highly flexible classroom made it virtually impossible for some of the teachers to transfer directly all of their experienced procedures to the setting of a new school. They felt that it would be necessary to modify their style of teaching or face the frustration of trying to teach in a way for which the building was not designed. Slowly they began to experiment with a less-structured total school program and found that the classes were productive and easy to manage. The children liked the relaxed atmosphere. With these success experiences, the teachers began to feel more secure in the new building.
>
> With respect to cohesion, it is important to note that four teachers were now compelled to perform as an independent group and also to make decisions together. At first, the function and authority of the teachers, head teacher, and supervising principal were not clearly understood, and problems were often circumvented rather than solved. In good time, however, these problems were faced and clarified. Whereupon, the group decided to attempt a total school project. The project was so successful that it created a new feeling of unity, and this, in addition to the success in reaching some of their educational goals, may partially account for the change in teacher preference for the new school.

Because of the building's open plan, Professor Lehmann points out, both the teachers and the children continued to report that there were more disturbing noises at the new school than at the old one. No real difference in the amount of natural lighting between the two schools could be observed. The teachers also stated they were more satisfied with the available storage space, the heating and ventilation, the amount of natural and artificial illumination, the accessibility of the lavatories and the general esthetic appeal of the classrooms as well as the entire building.

As this earlier report concludes:

> Most teachers approved of the new school environment, feeling that it made the children happier, easier to manage, and more enjoyable to work with. Most of the children felt that they were better behaved and happier at the new school than at the old school.

THE INITIAL PUBLICITY FURORE

Unfortunately, before the teachers and the parents of children at the Hoover School could be told of the forthcoming windowless classroom case-study (this announcement had been scheduled for April 1962), stories about the project began to appear in the newspapers. At the February convention of the American Association of School Administrators in Atlantic City there had been a seminar session on windowless schools which was chaired by Dr. Edward T. Hall, anthropologist and author of *The Silent Language* (and a consultant for the SER project). Reference was made to the impending study in Michigan. Suddenly, on 12 March, there appeared on the front page of the *Wall Street Journal* an article about windowless schools and the Michigan experiment. The story referred to the interest of the lighting and air conditioning industries in promoting windowless environments and how this would be to the disadvantage of the glass industry which had been enjoying the architectural vogue for classrooms with large window areas. The press services quickly picked up the *Journal* report and similar stories soon appeared in other newspapers throughout the country, including those serving Wayne and the Detroit metropolitan area, which headlined the case-study as an experiment in "paneless education."

The general image created by all this premature publicity was that of a traditionally designed schoolhouse whose windows were to be "boarded up" by a crew of esthetically insensitive carpenters. The Michigan researchers, it was implied, were ruthlessly intending to use the Hoover School youngsters as guinea-pigs in the interest of "science."

As a result the Hoover School parents and teachers became unduly disturbed and it was necessary to hold several meetings to allay their fears and doubts. Some families were in favor of the proposed case-study while others were indifferent, but many expressed the thought that their youngsters might possibly become mentally ill if they were deprived of a view to the outdoors while in school. It was pointed out in reply that the SER project staff included a specialist in child health as well as several psychologists, all of whom had given assurances that no harmful physiological or psychological effects were likely to

occur with the removal of the school windows. By promising that the children would be carefully watched and if there should be even the slightest indication of any harm to their health the windows would be immediately restored, the project staff finally received parental approval to proceed with the case-study.

The Hoover School teachers voiced no outright opposition but never having had any experience with windowless classrooms they were worried as to what new teaching problems might arise and how they would adjust individually. The Wayne school superintendent, Mr. Graham, continued to support the case-study, so also did the local school board members, and eventually the teachers agreed to come along also.

Whether this initial publicity furore might have an adverse effect on the case-study was, for a while, a matter of some concern to the SER project staff. Certainly both the pupils and the teachers had become strongly aware that they were the subjects of an investigation receiving widespread attention. In retrospect, however, it is clear the young children in the Hoover School had so little continuing interest in the case-study proceedings that they could not have been much concerned for any great length of time with public interest in their school. If there was a Hawthorne effect in their case, it was of very short duration.

As for the teachers, three of the four who were at the school in the first stage of the case-study did not return the following fall to participate in the windowless phase. This turnover in teaching staff, which is not unusual in the Wayne school district, did not occur because the school windows were to be removed but for other reasons. One teacher left because her husband, a student in the University's Law School, received his degree in June and the couple wanted to move elsewhere. The second teacher found a more desirable non-teaching job. The third was promoted to assistant principal in another Wayne school. Only the kindergarten teacher continued as before. It should be noted, however, that in the recruitment of new teachers for the Hoover School several candidates declined because they did not want to teach in windowless classrooms.

At first the SER project staff was disturbed by this change in teachers, but on second thought it became clear that the turnover might even be an advantage insofar as it served to minimize the possibility of a Hawthorne effect. The children would normally get different teachers anyway as they moved on to a higher grade at the beginning of each new school year. The teaching programs and the teaching methods were not changed, and in all other respects the classroom environments were kept as near the normal educational routine for each youngster as possible.

STRUCTURAL CHANGES IN THE TEST SCHOOL

Transforming the Hoover School into a windowless building required only a single weekend in August. The task was accomplished with so little fanfare that many residents in the neighborhood were not aware that the windows had been removed until the school was officially reopened shortly after Labor Day*.

Opaque panels of asbestos cement were substituted for the existing transparent dark-tinted glare-reducing Plexiglas window panels. New interior surfacings had to be applied to the wall studs to give a double-thickness wall similar to the other existing exterior walls. In effect, the window wall in each classroom became a fourth "working" wall. Each new teacher was asked to specify what she wanted for the new wall treatment in her classroom. After considerable thought and hesitation the kindergarten and first grade teachers requested more tackboards (homosote, painted white, as elsewhere in the school), while the second and third grade teachers asked for more chalkboards and shelving for storage of "tall" books.

Except for the introduction of the working walls in lieu of windows running full room length, the individual classrooms remained much the same as before (see "before" and "after" photographs in Appendix A). To compensate for the loss of daylight which previously had been obtained through the window walls, extra strips of fluorescent lamps were installed overhead in the roof-ceiling plenum; the additional light coming through the translucent plastic ceiling panels also served to illuminate the new chalkboards and wallboards.

Since the window walls had had hand-operated ventilating sashes which were now eliminated (incidentally, the teachers had complained that these sashes did not perform at all well), it was necessary to devise a supplementary ventilating system for each classroom: separate exhaust fans were introduced in the overhead roof-ceiling plenum to pull fresh air in from outdoors through the central air-intake of the school's warm-air heating system on hot days (when the heating system normally does not operate). Although every effort had been made to match the earlier environmental conditions, it was not possible to do so exactly. For instance, the transmission of heat between indoors and outdoors became quite different in going from Stage 1 to Stage 2, but this was inevitable consequence of substituting opaque walls for the transparent window walls.

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*The alteration work was done in collaboration with Sun Chien Hsiao, architect of the Hoover School, whose services were donated to the SER project by Mr. Attwood and the Unistrut Corporation.

One year later, at the beginning of Stage 3, the Hoover School was reconverted to its original condition even more quickly and, since no new materials for interior treatment of the classrooms had to be acquired, at even less cost. The local school officials requested that the new room ventilation system be retained in place of the old hand-operated window ventilating sash, and this was done since the project staff considered the variation from room conditions prevailing in Stage 1 to be a relatively minor environmental change and of no real significance in the case-study.

THE QUESTIONNAIRE SURVEYS

In each of the three case-study stages the teachers and youngsters were queried at length in an effort to discover what they liked and disliked in their varying environmental settings. During each survey period a substitute teacher was employed to enable each of the regular teachers to assist in the case-study by interviewing her own pupils individually within the privacy of the teachers room. For this work each teacher received a small stipend, but as the kindergarten teacher (who also functions as the school's principal) has observed, the chief reward was the fact that the interviews permitted the teachers to meet their pupils in private discussions without the rest of the class being present, and a more intimate and friendly teacher-pupil relationship was thereby obtained. The youngsters also expressed a liking for these individual interviews, apparently because for the first time in their school careers their own opinions were being sought on school matters. So popular were these case-study questionnaire surveys that the Hoover School teachers have actually recommended to the school superintendent that something similar be instituted as an annual procedure.

The responses to the various questionnaire surveys have been summarized as a working basis for this report. Anyone interested in obtaining a zerox-printed volume (soft cover, 200 pages, $8) containing the complete set of questionnaire summaries can do so by applying to University Microfilms, Inc., 313 North Fifth Street, Ann Arbor, Michigan. The volume is entitled "Summaries of Questionnaire Responses for the Windowless Classroom Case-Study."

Questionnaires Administrated at the Hoover School (test unit) and the Mann School (control unit).

Stage 1 Existing Windows (Spring 1962)
Teachers and pupils at the Hoover School
Teachers at the Mann School

Stage 2a Windows Removed (Fall 1962)
Teachers and pupils at the Hoover School

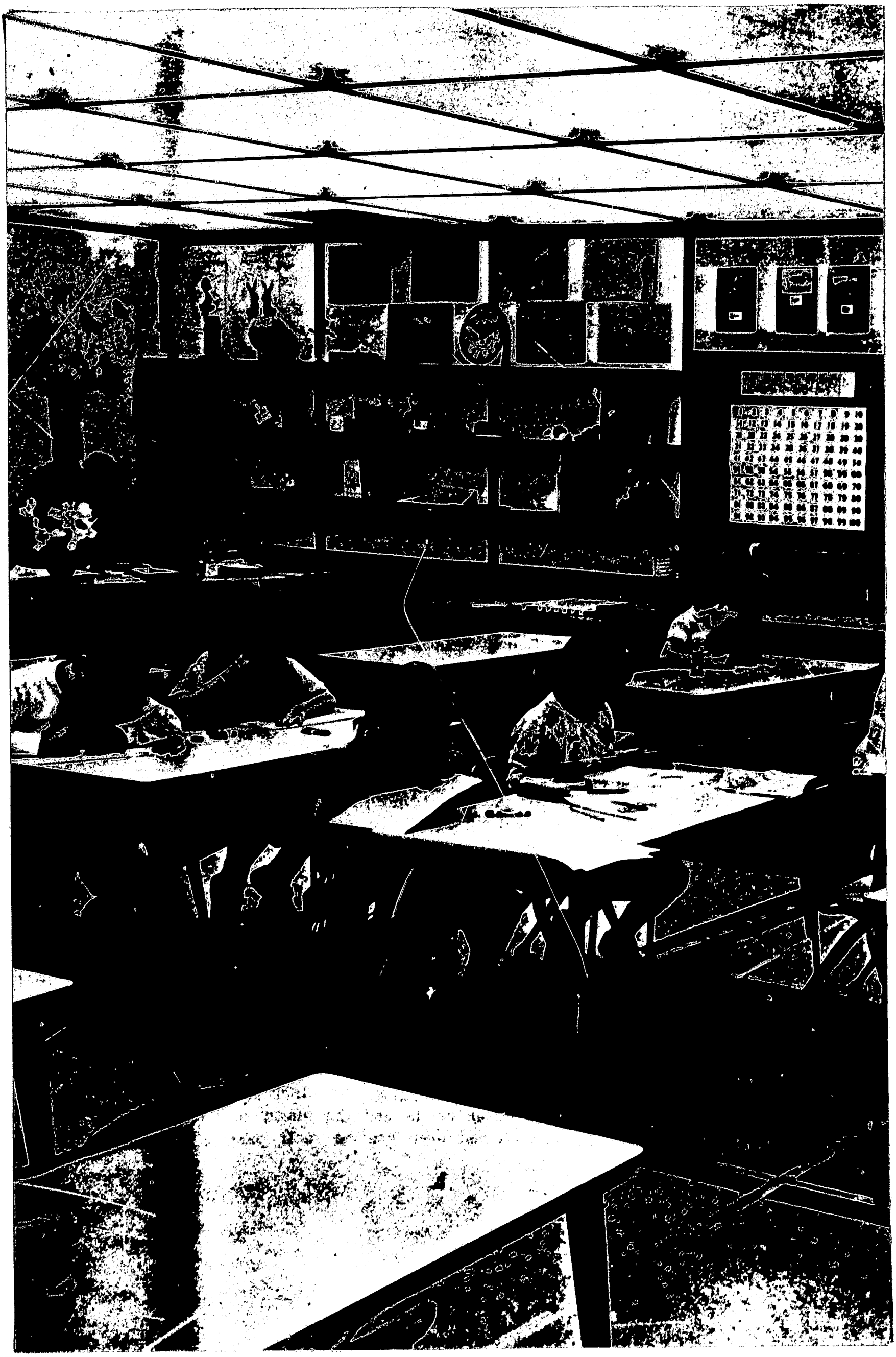
Stage 2b Windows Removed (Spring 1963)
Teachers and pupils at the Hoover School
Parents at the Hoover School
Teachers and pupils at the Mann School

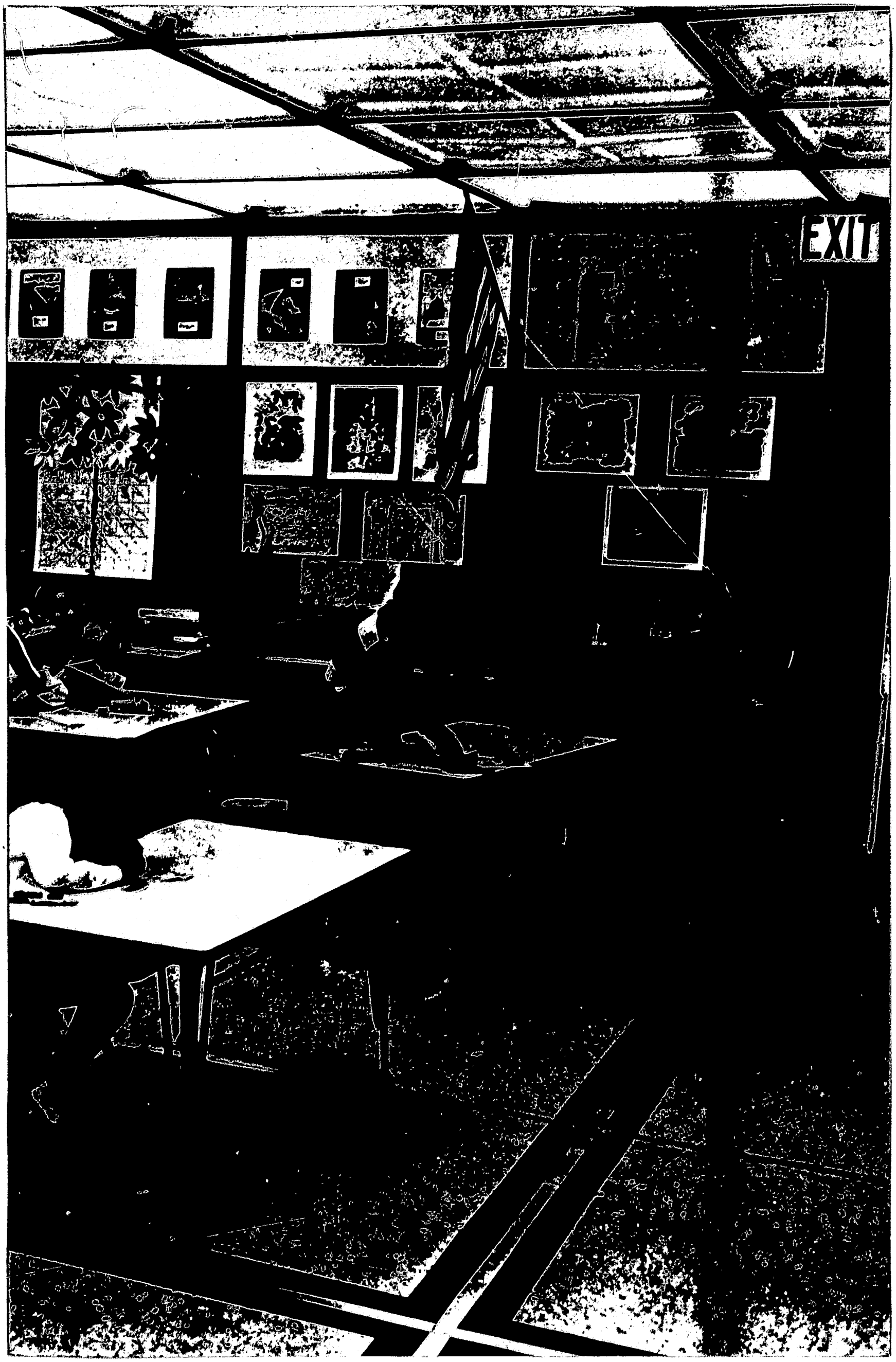
Stage 3a Windows Restored (Fall 1963)
Teachers and pupils at the Hoover School

Stage 3b Windows Restored (Spring 1964)
Teachers and pupils at the Hoover School
Teachers and pupils at the Mann School

The teachers were also asked in each stage to group their pupils according to ability—high, average, and low—and then, at the end of the school year, to rate each one as to whether the youngster had performed, in terms of ability, (a) better than expected, (b) about as well as expected, or (c) less well than expected. By covering the specific accomplishments of individual youngsters in several different learning activities—reading, spelling, writing, arithmetic and artwork—for each of three successive school years, insofar as such learning achievements could be observed and measured by individual teachers, a comparative basis was thus obtained for determining whether a windowless environment has any perceptible effect on the learning process. The analytical procedure and the individual pupil achievement ratings are described more fully in a following section of this report.

For two-week periods during each of the several questionnaire surveys each teacher at the Hoover School and also at the Mann School kept a daily log on both the prevailing weather conditions and the group behavior of their individual classes. This information has not been used in the windowless classroom case-study but is intended for use in other environmental investigations which the SER project staff has had in mind. It is worth noting, however, that the teachers very quickly observed that class behavior seems in general to vary with changes in local weather conditions, i.e., the children tend to be better behaved when the weather is pleasant and to become obstreperous when the weather turns bad. The one notable exception occurred in October 1962, during the windowless stage, when there was no perceptible correlation. Instead there was a general uneasiness among the children and a group anxiety that became more intense with each passing day, even though the weather remained good. By chance this particular logging of weather and class behavior had coincided with the Cuban crisis and the threat of thermonuclear war which the youngsters had been hearing their parents discuss at home.

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2

CASE-STUDY FINDINGS

CHANGES IN TEACHER ATTITUDES

As the summaries of questionnaire responses for Stage 1 testify (see supplementary volume available through University Microfilms, Inc.), the teachers were, in general, fairly well satisfied with existing conditions in both the test school and the control school. There were a few complaints—lack of privacy and disturbing noises from activities in other classrooms because of the open school planning, occasional room draftiness or room "stuffiness" depending on outside weather conditions and room location, some rattling of plastic panels too loosely held in the luminous ceiling frames, and so on—but these were offset by the "cheerfulness" of the whole school environment.

The children likewise expressed a strong liking for their classrooms, mainly because of the bulletin boards and the bright colors on the walls and floors. Very few in each class saw any reason for changing anything.

Although the earlier Hoover School teachers had been fearful of how they might react to a windowless environment, the responses to the questionnaire survey made in October 1962, only a few weeks after the new school year in Stage 2 had begun, show that the new set of teachers were already accepting the new conditions favorably. Without exception all stated that they found the absence of windows an advantage and offered the following explanations:

> No distractions from planes, no children at windows for mowing of lawns in the fall. We are never distracted from the outside. (Kindergarten teacher)

(1) No direct sunlight—no glare. (2) No distraction, such as weather, noise, playground. (3) More wall space to utilize. (4) We have an advantage of arranging the room more ways without the windows. (5) The room is more evenly heated. The temperature is about the same over the entire room. (First grade teacher)

No distractions. Ventilation better with fans than depending on cross ventilation from windows. No child must sit in draft so others may be comfortable. (Second grade teacher)

Younger children have a shorter attention span and therefore are easily distracted. The absence of windows eliminates outside distractions. (Third grade teacher)

In commenting on the changes in class behavior during this early period one of the teachers volunteered a description of her own behavior:

My reactions the first week were interesting to me. First day—I went directly to open doors. I felt closed in and the air was so still. Second day—same feeling. I wanted to open the doors to let the air in. Third day—the fan system had been repaired and the air was circulating very well. In fact I didn't know the day was very warm until I went home at 4:00. But when I arrived home I had the queerest feeling. I felt all closed in in my own house. I opened the draperies and then went and sat on the porch. It felt so good to be able to look into the distance. I sat out there for at least a half hour and then came in. I haven't had the same feeling since. I only had that feeling on that one day. I didn't feel closed in at the school, just after I came out. (Kindergarten teacher)

By the end of the school year the third grade teacher, who had liked her windowless classroom "less well" than the one in which she had been teaching previously, joined the first and second grade teachers in reporting that she now found it "more desirable." The kindergarten teacher continued to find her classroom was "about equal" in desirability, with or without windows. All still considered the absence of windows an advantage, for the following reasons:

The little children are not aware of any unpleasant weather conditions that might be frightening. (Kindergarten teacher)

No direct sunlight; no glare; no outside distractions; noise; weather conditions. More variety in sitting arrangements. (First grade teacher)

> Never have I had any interference from outdoor distractions, nor has any child in the classroom displayed any discontent from his experience in a windowless classroom. Also five boys have been behavior problems and I feel their behavior would have been intensified had there been windows in the classroom. (Second grade teacher)

> The children are not distracted by snow, sleet, rain, hail, strong winds, and other weather conditions. Other outside distractions are small children playing on the playground, older children from high school and St. Mary's Parochial School who have days off, that we do not have. They also play on the playground. (Third grade teacher)

After spending a full school year in a windowless classroom every teacher except one reported her general reaction as being "like very much." The main room characteristic for making them feel this way was the availability of more display space for children's work. As the second grade teacher explained:

> The room is large and well lighted. I have never once been aware of the lack of windows. There are adequate chalkboards, bulletin boards, cupboards, and a large working area.

The third grade teacher was the one who disagreed, stating that her reaction to her own classroom was "dislike very much." It was not the lack of fenestration to which she objected but the interruptions and lack of privacy caused by the classroom location and arrangement:

> The stove and kitchen sink are in the hall. Also, the milk cooler, furnace room and office. (All the teachers use the stove, sink and refrigerator in the hall.) As soon as anyone steps in the front door he or she is in the third grade room . . . . Constant interruptions. The office is used by the speech teachers and all children from the first and second grades are brought through my room . . . . Noises from other classrooms, especially the second grade. Keeping the large folding door closed helps to keep out some of the noise. However, this prevents circulation of air when the weather is extremely hot . . . . Utility-wise the hall is not part of my classroom. Even the children's coat rack is taken from the size of the room.

All the teachers complained about occasional draftiness in the individual classrooms during the winter months of Stage 2. There were also complaints about occasional "stuffiness" of the room atmosphere, particularly in the early fall and late spring months. The new system of

ventilation obviously was not much better than what had prevailed previously. When asked how they liked the new room ventilators, the teachers responded as follows:

> Not much. The only time it can be used is during an activity time or before and after the children have left. The noise is disturbing and children sitting under it or near it are unable to hear ordinary voices . . . . When it is on, I don't like to speak as loudly as I feel I should to be heard. (Kindergarten teacher)

> The ventilator is very effective. It is also very noisy. I only use the ventilator during recess, activity periods and lunch, unless the situation is very bad. When there is a fairly strong wind the vents on the outside of the building make noise. (First grade teacher)

> The new ventilator is adequate in serving its purpose, but it is noisy in operation. The noise, however, has not interfered with teaching. (Second grade teacher)

> It is too noisy. You cannot hear the children when they are reading or sharing something with the class members. Sometimes when the fan is turned on, we get the fumes from the power mower that is stored in the furnace room. On a few occasions when all the fans were turned on and doors opened, disagreeable odors have been removed, e.g., paint thinner and turpentine odors when used in art classes. (Third grade teacher)

When the teachers were informed that the classroom windows were to be restored for Stage 3, all voiced objection to this change except in the case of the kindergarten teacher who pointed out that "both arrangements have their good points." She agreed with the others, however, in saying that windows also offer disadvantages.

In responding to the questionnaire survey made in the early weeks of the next school year, the teachers indicated considerably less enthusiasm for their classrooms with the restoration of the windows. They cited these specific objections:

> The children can see the nice weather and it is harder to keep their attention. They can more easily hear other children on the playground—thus making them wish to go out too. Several children go to the front window to see if the "safety boy" is at his post. I believe, on the whole, there are many more distractions. (Kindergarten teacher)

Many more distractions including: (1) weather; (2) noise from children, traffic; (3) direct sunlight. I don't like venetian blinds. Sitting arrangement limited. (First grade teacher)

There is less bulletin board space. Neither the children nor I were ever aware of the room being windowless last semester. And this semester with the windows in I do not feel there is any advantage with learning or behavior, so this space would broaden our classroom activities. With the windows removed: (1) more interest tables, (2) more bulletin board space, (3) better arrangement of bookshelves. (Second grade teacher)

The slower children are distracted by activity outside much more than last year when I substituted in this room. I would probably like windows if they were higher—say one place blocked in for use as bookshelves, bulletin boards, etc. The low windows give a full view of all ground activity. While the more mature children take this in stride, the less mature (and usually those who have difficulty completing—short attention spans, etc.) find it difficult not to blurt out with a comment or start a discussion with the immediate neighbor. (Third grade teacher)

At the end of the school year in Stage 3 the teachers were queried once again in regard to their re-windowed classrooms. In response to the question of what they now liked most about each classroom came the following replies:

> Bright colors, openness, warm floor, cupboard fronts are painted brilliant colors . . . . The heating pipes are under the floor, so children are usually warm on floor while sitting. (Kindergarten teacher)
>
> I don't know. I like the room very much. (First grade teacher)
>
> The size and the colors used. (Third grade teacher)

The question of what they liked least in each classroom produced the following replies:

> The room becomes stuffy both in winter and warm weather and in the extreme heat during fall and spring. We are not able to use the fan because of the noise and we are not able to open the door because the wind blows ceiling pieces down and rattles the whole ceiling . . . . The thin walls and too many tables and chairs for size of room. I feel that my children in their exuberance may disturb other rooms. (Kindergarten teacher)

No door going into the multi-purpose room . . . . The noise from the first grade disturbs other children. The noise from the second and third grade disturbs the first grade. All the noise from the multi-purpose room distracts the first grade. All of the teachers hesitate to use the multi-purpose room for this reason. (First grade teacher)

The fan . . . . too noisy. I find the children talk to get above the motor whirr, then I do too and soon we are very noisy. (Third grade teacher)

All the teachers reported they had been uncomfortable at times during the school year. Asked as to the cause of the discomfort, the teachers replied as follows:

The heat in the fall and spring. When the children are too warm, they do not respond as well as when they are comfortable . . . . The windows will not open--only the door. We often need air in the room and when we open the door, if it is windy at all the ceiling rattles so we have to close the door. (Kindergarten teacher)

Weather--the room is too cool in some areas in the winter, and much too warm in spring and fall . . . . I cannot have the children sitting in the areas where it is too cool or too hot. If we turn on the fan, our voices become louder and louder. If we open the door, our display boards are destroyed and the things on our desks are blown about. Also some of the children will be in a draft while others will hardly benefit from the door being opened. When the door is opened, this makes the ceiling panels rattle and squeak more. (First grade teacher)

Our classroom is very warm and stuffy when warm weather comes, especially in the afternoon . . . . It is difficult to retain the children's attention. (Second grade teacher)

Temperature, too cold or too hot . . . . If I have a sweater on, I am all right. However, if a cold air return were installed I feel our winter problem could be minimized. Also, there is no temperature control in this room. The thermostat for our room is in the second grade room! Also, there's no air return in this room, and it is about 6-10^0 colder than the other rooms on any given day. (Third grade teacher)

These expressions of teacher opinion may perhaps give the impression that, when the classroom windows were restored without putting the original ventilating sash back in but retaining the new room ventilators instead, Stage 3 had not been made strictly comparable with the conditions of Stage 1. If so, then teacher reluctance to use the ventilators because of their noise had obviously introduced a new environmental factor, but this same acoustical condition, it should be noted, had prevailed throughout Stage 2 without arousing nearly the same amount of teacher concern.

It should also be noted that similar complaints about room ventilation had been voiced by the teachers participating in Stage 1. In commenting on the environmental factors that made them uncomfortable in this earlier phase, the teachers had cited the following:

> Not to have fresh air during early fall and spring—sometimes need to "air" out room between classes. The windows have had to be nailed shut because of the poor construction of the opening levers and on warm days this building is H O T . . . . We are not able to open but one window so we open the door, too—quite frequently. (Kindergarten teacher)

> The heating problem. (First grade teacher)

> We have been quite warm in the early fall and late spring. We have also felt drafts from the door and window in the winter time. (Second grade teacher)

> The warmth in the room during the spring and summer months. I can only open one window. It's terribly warm. (Third grade teacher.

Despite all the complaints about the acoustical and ventilation difficulties prevailing in Stage 3, the new set of teachers at the Hoover School said they liked the rewindowed classrooms "very much." Curiously enough, the second grade teacher, who dissented from the others by turning in a "like only slightly" answer, was also the one who stated "it fits my ideal of a classroom."

These teacher reactions illustrate the confounding effects produced by the ventilation and open plan complications of the Hoover School as well as by their own expectations and the conforming pressures that exist in any group. Perhaps the best evidence of a change in attitude is simply the fact that on each of the several visits made by SER project staff members to the test school since the ending of Stage 3 each teacher

has eagerly asked how soon it will be before the classroom windows are once again removed and an air conditioning system installed as the working basis for another environmental case-study. Even the Mann School teachers, whose own attitudes remained fairly constant throughout the three stages, are asking why their building shouldn't be selected as the environmental test unit instead of being merely a control unit if such a case-study is to be undertaken.

CHANGES IN PARENT ATTITUDES

In the questionnaire survey made soon after the beginning of the windowless stage the Hoover School teachers were asked if they had had any comments from any parents. Two teachers reported favorable reactions:

> Three parents asked where the windows were. Several parents indicated they hadn't even missed the windows on entering the room. (Kindergarten teacher)

> One father stated that the classroom looked much better (from the inside), and he thought it was better to eliminate the outside distractions. One mother stated that she checked with a psychiatrist at Northville Hospital and was assured that the elimination of windows could do no harm to the children. She also said, "I don't sit by my windows and look out. I'm much too busy for that." (Third grade teacher)

Asked if there were any unfavorable comments, one teacher reported the following:

> Only one parent has said anything to me. One occasion, she felt the parents should have been consulted first, since this concerned their children. She felt the parents were treated like they were stupid. On another occasion she said, "God gave us the sun to enjoy, and no one has a right to take it away from us." Still another time she said, "They promised to check on our children every two weeks or so." (Third grade teacher)

At the end of the windowless school year the teachers reported the following parent reactions:

> Just general questions to see how I liked it or if the lack of windows bothered me. Parents always ask, "How do you feel about it? Do you feel closed in?" Some even have asked where were the windows. Also mentioned the nice usage of the extra bulletin board space. (Kindergarten teacher)

At openhouse one parent was voicing his opinion. It was an adverse opinion. It was my husband's first visit to the school and I was asking his opinion about the windows. He had heard much discussion at home. Unfortunately our conversation was overheard by this parent. (First grade teacher)

In having conferences with parents, four of them mentioned the windowless classroom. Their general inference was, "How do stand it in a windowless classroom?" Incidentally, only one parent attended the recent meeting, May 23rd. (Second grade teacher)

One mother said, "God made the sunshine for us to enjoy." Another said, "I checked with my doctor and he assured me there could be no harm; besides, I don't sit and look out my windows." A father said, "I think it is much nicer without windows." At parent-teacher conference time three or four mothers said, "The children don't even miss the windows being out, do they?" One mother said, "I don't like being in my basement even in the summertime. I like to be where I can look out the windows." This mother was one of the original objectors. (Third grade teacher)

Upon restoration of the classroom windows, at the beginning of the new school term, the teachers were again queried about the parents and their reactions:

Many of my parents are new to Hoover School and several asked how the windows had been blanked out. Some (possibly 10-12) said, "I'll bet you are glad to have windows again," or, "How did you really feel when you were not able to see out?" .... To me parents have been quite indifferent concerning windows or not. If they open the subject I have just said that it doesn't make much difference to me either way. The children are interested in other children, me, and the complete joy of just being "big" enough to come to school. If the children are happy, I am happy. And with the windows restored, I believe I have to work a little harder to keep them happy because now they can see older children out for recess and it gives the kindergarteners the idea that might be fun too. Two parents said, "Oh, you are finished with the project concerning the windows." A new teacher at Monroe said, "I thought you were not going to get the windows back this year." (First grade teacher)

> One parent in registering her child said, "I see the windowless experiment failed. It must not have been a very good idea." (Second grade teacher)
>
> Parents noted presence of windows and wondered if the experiment was over and wondered about the results. Most parents do not really care if there are or are not windows as long as the child shows normal progress. Many (about 6) said they thought it less distracting for students without the windows. (Third grade teacher)

The final survey at the end of the restored window stage produced the following teacher replies:

> When a few parents enrolled their children in the fall, they were wondering how the windows were closed. Some four or five parents wanted to know how I liked it. They didn't think they would like it . . . . Some parents have said they thought the most important factor is the teacher inside the classroom and whether or not the child enjoys the teacher. (Kindergarten teacher)
>
> The parents thought we were not going to have windows this year. They thought the experiment had stopped when they saw the windows. (First grade teacher)
>
> Two different parents mentioned the replacement of the windows last September. The comments were neither favorable nor unfavorable—simple curiosity. (Second grade teacher)
>
> About twelve parents commented on the pleasantness of the room. They wondered what just having windows out one year was going to prove. But they were definitely interested and proud to have their children be part of the experiment. Most would like to know of the results of the experiment. (Third grade teacher)

At the outset of the case-study, in May 1962, all parents of pupils in the Hoover School had been sent a 2-page letter explaining the objectives of the investigation. This document stated clearly that the study would go through three stages—"first, a period of time with windows as they are, then a period of time when windows are covered, and finally, a period of time as windows are restored to their original condition"—but apparently the fact that a third stage was indicated had been completely

forgotten by many parents. It should be noted, too, that the teachers, who had been even more thoroughly briefed, were taken by surprise when they discovered at the end of Stage 2 that the classroom windows were to be restored during the summer recess.

A questionnaire was also sent to all parents at the end of the second stage asking specifically (1) how they felt when they first learned their youngsters were to be in a windowless school and (2) how they now felt after the children had spent a whole school year in a windowless environment. Some 26 families responded. As shown by the summary of their replies (included in the supplementary volume), there was no substantial shift in parent attitudes: those who favored the case-study at the outset—a strong majority—continued to feel the same way at the end of the windowless stage, and those who had misgivings about the study—a definite minority—likewise continued to maintain a fixed position throughout the whole period.

CHANGES IN CLASSROOM BEHAVIOR

The youngsters in both the test school and the control school—to judge from the questionnaire surveys covering periods when the classrooms have had windows—showed very little interest indeed in the subject of fenestration. (For a detailed analysis of pupil responses to questions dealing with environmental features in their classrooms at different case-study stages, see Appendix B.)

As a general rule, only occasionally have as many as one or two children in a class singled out windows as the classroom feature they like best. By the same token the windows are not an active dislike with the children. Their attitude can be described as one of almost complete indifference.

Even when the windows were removed in the Hoover School, there was relatively little pupil reaction. As the teachers noted in response to the first survey in Stage 2 asking whether there had been any comments by the children concerning the absence of fenestration:

> One day when it had rained as they came to school a child wanted to know if he should wear his raincoat. I answered, "I don't know." "Well," said he, "if we had windows, we would know if it was raining." (Kindergarten teacher)

> Upon my request the children drew pictures about the school. One child drew a window and realized it was wrong. She said, "Whoops, I made a boo-boo." She then took her crayon, drew an X through it and continued drawing. (First grade teacher)

Until the children had been interviewed, I had had only one comment. It was on a hot day in the fall—the child thought perhaps windows opened might have helped. This occurred one day when the fan was not operating. On registration day, no parent mentioned windows or lack of windows. (Second grade teacher)

Two or three children mentioned the absence of windows and how they thought this helped. All the children who were in Hoover School last year said they liked the room better than the room they had last year. (Third grade teacher)

Asked if they had been able to detect any change in classroom behavior or deportment that could conceivably be attributed to the elimination of classroom windows, the teacher replied as follows:

The children do not seem to be settling down as well as in years past—but I have 12 more children this year in my two groups. I do have 3 or 4 children who have been emotionally upset from the first day, but these are children who for five years did not adjust to new situations easily so I do not consider that this is because of the windows. When one or possibly two of these children are upset I naturally do not give my attention to the whole group while I am working with the troubled child.

The first week of school four children who had formerly been in Hoover School asked if they might come in and look around. As they entered the third grade classroom I heard remarks such as these: "Oh, it's pretty in here. Didn't have all those books over there." "We didn't have those shelves." "This isn't the way it looked when I was here. I said, "Well, what is different about the room?" "Those shelves, the chalkboards, all these pictures on the bulletin boards." "Anything else," I asked. One sharp little guy remarked with much force and expression, "Oh! I know, the windows are gone." But that wasn't the first thing he noticed. (Kindergarten teacher)

Children are more attentive. (First grade teacher)

On pleasant days, I doubt if there is much change, but there isn't the distraction with rain, snow, etc. that is common when the children can see. I don't believe overcast and dreary days cause the restlessness that sometimes occurs. On several occasions the class, including myself, wouldn't know it was raining until we were out. (Second grade teacher)

(No reply by third grade teacher)

At the end of Stage 2 the youngsters were asked if they had ever wished for windows in their classrooms during the school year. The morning kindergarten class reported 28 yes and 3 no, the afternoon kindergarten class 25 yes and 5 no, the first grade 16 yes and 8 no, the second grade 13 yes and 10 no, and the third grade 13 yes and 13 no, thereby indicating what appears to be a lessening desire for school windows with advancing school age. The youngsters answering yes were also asked how frequently they missed the windows: 13 of the morning kindergartners said very often and 3 very rarely; 11 of the afternoon kindergartners very often and 2 very rarely, 6 first-graders very often and 5 very rarely, 5 second-graders very often and 7 very rarely, and 2 third-graders very often and 3 very rarely.

The teachers reported only a few scattered comments by the youngsters about the lack of an outside view throughout Stage 2.

> The children were wondering sometimes about the snow, rain or general weather conditions. Asked if they might open the door to see if it was raining so they would know whether to put on raincoats or not. Also wondering if it was warm enough to go to the playground. (Kindergarten teacher)

> One comment from one pupil. I think this was a result of my reaction to the first large snow. I could not refrain from opening the door to view the snow. (First grade teacher)

When the parents were asked how they thought their children now felt after being in a windowless classroom for a whole school year, 11 said the youngsters "don't care, one way or another," 6 said they were "a little dissatisfied," and 2 "much dissatisfied." One parent said his child liked it "very much," another "just so-so," and still another "I don't know." Five of the responding parents refrained from answering this particular question.

Three parents thought their children had learned better in a windowless environment while none reported that his child had not learned as well. Eleven of the responding parents observed no effects whatsoever on the learning achievements of their youngsters, however. No parent thought the case-study had been unhealthful for the children, and only two believed it had made them at all unhappy.

After the windows had been restored and another school year had gone by, the teachers were asked again if there had been any comments by

the youngsters. The only comments heard were those that had been elicited in response to the pupil questionnaires.

Asked if they had been able to detect any change in class behavior or deportment that conceivably could be attributed to the restoration of classroom windows, the teachers offered the following replies:

> When the weather is bad, i.e., rainy or cloudy, the children are restless. Their attention span is shorter. I never do any type of testing on these days because the children seem to be more upset. (First grade teacher)
>
> Although I have a well behaved group, they cannot help but look out at other children playing during recess. And, also, if the weather is stormy, this is upsetting to the children. (Second grade teacher)
>
> As I remember, I was not conscious of as much interruption in that third grade class as this one. However, these are two different groups of children and 24 different *individuals*. (Third grade teacher)

CHANGES IN LEARNING PERFORMANCE

The case-study has sought not merely to determine the changes in attitudes that occur with actual exposure to windowless classrooms but rather, more importantly, to discover whether such an environment has any perceptible effect on the learning achievements of the youngsters.

At the end of each of the three stages the teachers in both the Hoover School and the Mann School submitted, as requested, complete listings of their pupils grouped into three categories: (1) those with high ability, (2) those with average ability, (3) those with less ability. In each of these category listings the children were further identified as to whether they had performed (a) better than expected in light of their ability, (b) about as well as expected, or (c) less well than expected, in each of their various classroom studies. These studies were specified as the following: reading, spelling, writing, arithmetic, artwork.

The teacher appraisals of pupil ability and achievement, although based on standard tests (the Iowa Test of Basic Skills and the Gates Reading Test), are admittedly subjective insofar as they involve adjustments in individual cases. The difficulty of judging relative achievement has introduced a considerable amount of elasticity into the measures of

individual pupil performance, and suspicion of any striking differences in teacher judgment is therefore justifiable. The only excuse that can be offered for using such appraisals in this case-study is that this is the normal academic way of judging individual pupil performance. If considered questionable practice here, then perhaps a fresh look should be taken at the "grading" system that prevails in our nation's schools.

The collected data could have been processed by computer methods to good advantage, but because of the smallness of the sample, it was decided instead that the appraised information should be transferred onto individual 4" x 6" file cards so designed that the complete record of learning achievements by each youngster over the entire 3-year period could readily be seen at a glance.

Each processed file card has a space in the upper lefthand corner for identification of the child and the particular school. Below, in three horizontal divisions corresponding to the three phases of the case-study are spaces for identifying the particular grade and individual boxes for noting both the pupil's level of ability and the pupil's level of achievement in each of the five specified subjects studied in that particular school year.

In marking the individual boxes on each pupil's card, the SER project staff assistants used blue to denote a high level of ability, yellow an average level, and red a lower level. The same sequence of colors (blue, yellow and red) was employed to denote the three levels of learning achievement—better than expected, about as well as expected, and less well than expected.

The readily apparent contrasts in color recorded on each file card made it very easy to see immediately the extent to which each child has varied in rated ability and in rated learning achievements in moving from one grade (or case-study phase) to the next. By using a separate card for each child, it has also been possible to group the individual cards into many different combinations—by school, by classroom grade, by sex, by rated ability, by specific study subjects.

The total number of pupils enrolled in the Hoover School and in the Mann School for the entire 3-year period is shown in Tables 1 and 2.

Each school, it should be noted, has two kindergarten classes, one in the morning session and the other in the afternoon session. Not all of these kindergartners go on into the first grade in the same school; some transfer into the nearby parent schools for which the case-study test unit and control unit serve as "feeders"—the Monroe School in the

Table 1. HOOVER SCHOOL ANNUAL ENROLLMENTS

	Kindergarten		Grade 1	Grade 2	Grade 3	Total School Enrollment
	a.m.	p.m.				
Stage 1, With Windows (1961-62)	21	20	30	29	24	124
Stage 2, Windows Removed (1962-63)	29	30	24	23	26	132
Stage 3, Windows Restored (1963-64)	36	27	33	18	23	137

Table 2. MANN SCHOOL ANNUAL ENROLLMENTS

	Kindergarten		Grade 1	Grade 2	Grade 3	Total School Enrollment
	a.m.	p.m.				
Stage 1 (1961-62)	27	21	30	25	28	131
Stage 2 (1962-63)	25	27	30	27	27	136
Stage 3 (1963-64)	25	24	33	27	26	135

case of Hoover and the Taft School in the case of Mann. Each kindergartner who continued on in either the Hoover School or the Mann School during the case-study period has been easily identified through the use of the individual learning achievement record cards.

Pupils who were in the third grade for the first stage also dropped out of consideration since they were in other schools during the windowless stage. Pupils originally in the second grade likewise dropped out of consideration after the second stage of the case-study. Similarly, children who entered kindergarten in the third stage were subjects of study for only one year, while those who entered in the second stage were avail-

able for only two years. On this basis it is apparent that only the youngsters who were in either kindergarten or first grade during the first stage could have performance cards that carry through all three stages of the case-study. Of these, many became transfers to other schools (their departures being offset in part by transfers coming in from other schools), so in the aggregate the total number of individual performance cards covering the entire case-study period reduces to exactly 31 for the Hoover School (13 who were in kindergarten and 18 in first grade during Stage 1) and exactly 35 for the Mann School (16 in kindergarten and 19 in first grade during Stage 1).

By adding the children who were in the Hoover School for only two stages (a total of 59) to the number who were there for the entire case-study period (31), there is obtained a grand total of 90 individual cards permitting direct comparisons between pupil performance in classrooms with windows and pupil performance in classrooms without windows. For the Mann School the grand total amounts to 100 individual performance cards (65 covering two stages only and 35 covering the entire case-study period).

Visual inspection of the 90 cards developed for the test school reveals a wide variety of individual pupil performance. Some children did better in a windowless environment, some did worse, while others did the same as they did before or after. Although various members of the SER project staff have tried sorting the cards into different groupings and classifications, no consistant pattern of pupil performance in going from one stage of the case-study to another has been detected that could be ascribed to the absence of an outside view.

The value of having had a control unit as a check on the test unit becomes evident when the 100 cards developed for the Mann School are also examined. Here too there was a random variation in pupil performance in the transition from one grade to the next throughout the 3-year period. No pattern of class behavior can be detected which would indicate that a view of the outdoors has been essential in the learning process for these particular youngsters.

As Dean Willard Olson of the University's School of Education has pointed out in his own studies of child growth (see *Child Development.* 1959 edition, D. C. Heath & Co., Boston), children tend to vary greatly in their individual rates of development. These differences are so large and predictable through time, that changes attributable to organization or emphases in method cannot usually be determined with certainty. Individual records over brief periods show ups and downs because of errors of measurement and unknown factors.

Table 3. LEARNING ACHIEVEMENTS OF TEST SCHOOL PUPILS (HOOVER) IN STAGE 2 (WINDOWS REMOVED) AS COMPARED WITH THEIR PERFORMANCE IN OTHER STAGES OF CASE-STUDY

3-Year Comparisons	High Ability	Average Ability	Less Ability
13 pupils (K-1-2)	6 better	3 better 1 same 1 less well	2 better
18 pupils (1-2-3)	2 same 3 less well)	1 better 7 less well	3 better 2 less well
2-Year Comparisons			
8 first graders (K-1 or 1-2) not covered above	2 better	1 better 1 same	2 better 1 same 1 less well
4 second graders (1-2 or 2-3 not covered above	2 less well	1 same 1 less well	
23 third graders (2-3)	8 better 3 same 5 less well	2 better 1 same 1 less well	1 better 2 same
24 kindergartners (K-1)	2 better 1 same 5 less well	1 same 10 less well	1 better 2 same 2 less well
	18 better 6 same 15 less well	7 better 5 same 20 less well	9 better 5 same 5 less well
	39 pupils	32 pupils	19 pupils

In this particular case-study the variations in individual development in both schools were often so pronounced that some children rated as having a certain level of ability in the class received an entirely different rating by the teacher the following school year. For example, two children in the Hoover School jumped from "low" to "high" in ability within two successive years while two children dropped from "high" to "low" during the same periods. A similar variation occurred also in the Mann School. However, a large number of the cards—49 for the Hoover School and 49 for the Mann School—show consistently uniform ability ratings for each child.

By grouping the cards for the Hoover School and Mann School youngsters according to ability (as determined by at least two teachers in the 3-year sequences and by the Stage 2 teacher in the 2-year sequences), and then comparing their learning achievements in Stage 2 with their learning achievements in Stage 1 and/or Stage 3 (in general rather than by specific subjects), the approximations shown in Tables 3 and 4 are obtained.

Table 5 sums up for each school how well the children performed in Stage 2 as contrasted with the other two phases of the case-study. The close parallel in pupil learning achievements between the two schools

Table 4. LEARNING ACHIEVEMENTS OF CONTROL SCHOOL PUPILS (MANN) IN STAGE 2 (WINDOWS REMOVED) AS COMPARED WITH THEIR PERFORMANCE IN OTHER STAGES OF CASE-STUDY

	High Ability	Average Ability	Less Ability
3 Year Comparisons			
16 pupils (K-1-2)	1 same	4 better 5 same 5 less well	1 better
19 pupils (1-2-3)	3 better 3 less well	7 better 1 same 5 less well	
2-Year Comparisons			
9 first graders (k-1 or 1-2) not covered above	1 better 1 less well	1 better 1 same 5 less well	
7 second graders (1-2 or 2-3) not covered above	 2 less well	 1 same 2 less well	2 better
21 third graders (2-3)	 1 same 5 less well	4 better 3 same 6 less well	 2 same
28 kindergartners (k-1)	2 better 4 same 2 less well	8 better 1 same 6 less well	5 better
100 total pupils	6 better 6 same 13 less well	24 better 12 same 29 less well	8 better 2 same
	25 pupils	65 pupils	10 pupils

Table 5. CONTRAST OF PUPIL ACHIEVEMENT RECORDS IN TEST SCHOOL AND CONTROL SCHOOL FOR STAGE 2 (WINDOWS REMOVED) AS COMPARED WITH PUPIL PERFORMANCE IN OTHER CASE-STUDY STAGES

	Test School (Hoover)	Control School (Mann)
Pupils who performed better	34	38
Pupils who performed the same	16	20
Pupils who performed less well	40	42
	90	100

hardly permits any other conclusion than that classroom windows have very little if any effect on a child's ability to learn.

It should be noted, however, that when the teacher evaluations of pupil performance are divided into high scores and low scores for the first, second and third grade classes in the Hoover School (excluding the two kindergarten classes), there is a relatively smaller percentage of pupils, both boys and girls, who achieved high scores in Stage 2 than in either Stage 1 and Stage 3, but this variance does not follow an easily explainable pattern. (For a more detailed discussion of this point, see Appendix C.)

In general it can be said that child development theory could have predicted the environmental variation outcome in terms of measured school achievement for this type of case-study. The subjective judgments of the Wayne school teachers appear to have worked out similarly.

CHANGES IN THE RATES OF ABSENTEEISM

The idea of using the school attendance records as a check on the effects of classroom fenestration had not seemed particularly significant to the SER project staff and nothing was done in this connection until nearly the end of the case-study period. Fortunately, it was an easy task to obtain the data from the Wayne School District and to make comparisons between stages and between classes as well as between the test school and the control school.

As the detailed analysis presented in Appendix D brings out, there was no appreciable variance in the rates of absenteeism for the total popu-

lation of either school over the three stages of the case-study. However, when the classes are considered separately, then a very interesting difference emerges: during the windowless stage, the curve showing the absences of children in the kindergarten classes in the Hoover School went up while the curves for children in the other three grades went down. Furthermore, in Stage 3 these same curves tended to return to the levels that had been established in Stage 1. The variance becomes even more pronounced when the different classes are compared on the basis of extreme absence ratios (the number of pupils with more than 10 absences divided by the number of pupils in each class).

Exactly how to account for this observed difference in the rate of absenteeism between kindergartners and the children in the other three grades has been a matter of considerable speculation by the SER project staff. Some members are frankly skeptical as to the significance of absenteeism. They point out that, as a general rule, school attendance improves with school age, and this is confirmed by the charts in Appendix E showing that the absence rates become progressively lower as the children become older. Other staff members argue that the variance in the kindergarten absences during the windowless stage, as contrasted with those for the other three grades, is nevertheless too strong, statistically, to be ignored.

One seemingly plausible explanation for this variance is that knowledge of the fact that the Hoover School windows had been eliminated in Stage 2, coupled with uncertainty as to the healthfulness of such an environmental change, may have induced the mothers of the kindergartners to keep their youngsters at home more frequently than they would have done normally. This theory unfortunately does not explain why the mothers of children in the other three grades should have worried less in Stage 2 than in Stage 1 or Stage 3.

Another explanation is that the variance is just a statistical accident, a "happenstance," and not likely to occur again. The Hoover School experience provides only a small sample of pupil behavior which may not be repeated in other instances. If other similar environmental case-studies had been going on at the same time and the same phenomenon could have been observed elsewhere, then there would be no doubt as to its validity. Because of the uncertainty the observed variance has created, all agree that it should be given further attention. Certainly the problem of absenteeism must be included in any future case-study of this sort.

GENERAL CONCLUSIONS AND PROJECT EVALUATION

Summing up, it must be again emphasized that this particular case-study has been primarily a pilot operation, an effort to find and develop the

techniques of investigation that seem best suited to the obtaining of the data needed in evaluating the effects of environment on human behavior in general and on the learning process in particular.

Admittedly the techniques employed in this initial undertaking by the SER project staff could be improved, as they most certainly will be in any similar environmental case-studies that may be undertaken in the future. Much of the information collected in the teacher and pupil questionnaire surveys now appears, in retrospect, somewhat irrelevant. The influence of teacher biases is evident in many of the pupil replies. In any future case-study it seems advisable to have time-sampling studies of teacher and pupil behavior in addition to the subjective reports.

Furthermore, it must be remembered that the Hoover School represents only a very small statistical sampling—kindergarten and the first three grades—in a community that is typically only a small part of a large industrial metropolis. Whether older children or children of the same age level in other communities throughout the United States will react the same way is not known, nor is it certain whether the behavior of the test pupils is at all typical of other children in the same community.

For these reasons the findings in the present case-study cannot be considered definitive or conclusive. Nevertheless, it is believed they are indicative, particularly insofar as they suggest trends that call for further study.

The removal of windows in the Hoover School has obviously had some effect, even though indirect, on the behavior of the youngsters. The variance in the absence records of the kindergarten children as distinguished from those for children in the three older grades suggests a relationship to fenestration that should be investigated further. Some concern for an outside view is also evident in the pupil responses to changes in environmental factors. In the main, however, the test school children have shown very little personal interest in whether their classrooms had windows or not.

A windowless environment may also have some effect on the learning achievements of youngsters, but if so, it is small. The effect seems to depend on the nature of the group—whether the class is task-oriented or not. It may also be due to changes in teacher practices, or it may relate to more subtle factors implicit in group behavior as well as individual behavior.

More case-studies of windowless classrooms are obviously needed to substantiate these initial observations. Environmental research is an area of investigation where there should be little concern as to dupli-

cation of effort. Numerous examples are needed in order that there may be an ample basis for making comparisons. It is only through such comparisons that definitive conclusions can be drawn as to the effect that various environmental conditions may have on human behavior, and it stands to reason that the more comparisons of this sort that can be made, the sooner can an environmental science be built up as the working basis for a more effective kind of environmental design.

The one positive finding that does emerge from the Hoover School experiment is the remarkable shift in attitude by the teachers. There is no question as to their preference for windowless classrooms, once they have had the experience of teaching in such an environment, and they are unanimous in their reasons for not wanting the windows: the children are no longer distracted by outside happenings when the classrooms become windowless, and besides, the extra wall space can be put to good instructional use. Several professional educators, however, have questioned whether the elimination of outside distractions is always something to be desired. An exterior happening may frequently provide a fruitful stimulus to educational activity within the classroom, particularly if the class, as in the case of kindergartners, does not have a strict set of learning tasks. In rebuttal it can be argued that most school work has a definite educational focus, and therefore relatively few classrooms would find much educational advantage accruing through the windows.

As Stanford C. Ericksen, director of the University's Center for Research on Learning and Teaching (and one of the SER project consultants), sums up this debate on the educational value of schoolhouse fenestration: "The curious child in a well-conducted classroom already has an information input overload, adequate sensory and social stimulation, and apparently has little need for whatever might be added by looking out the windows."

THE NEED FOR A NEW ARCHITECTURAL APPROACH

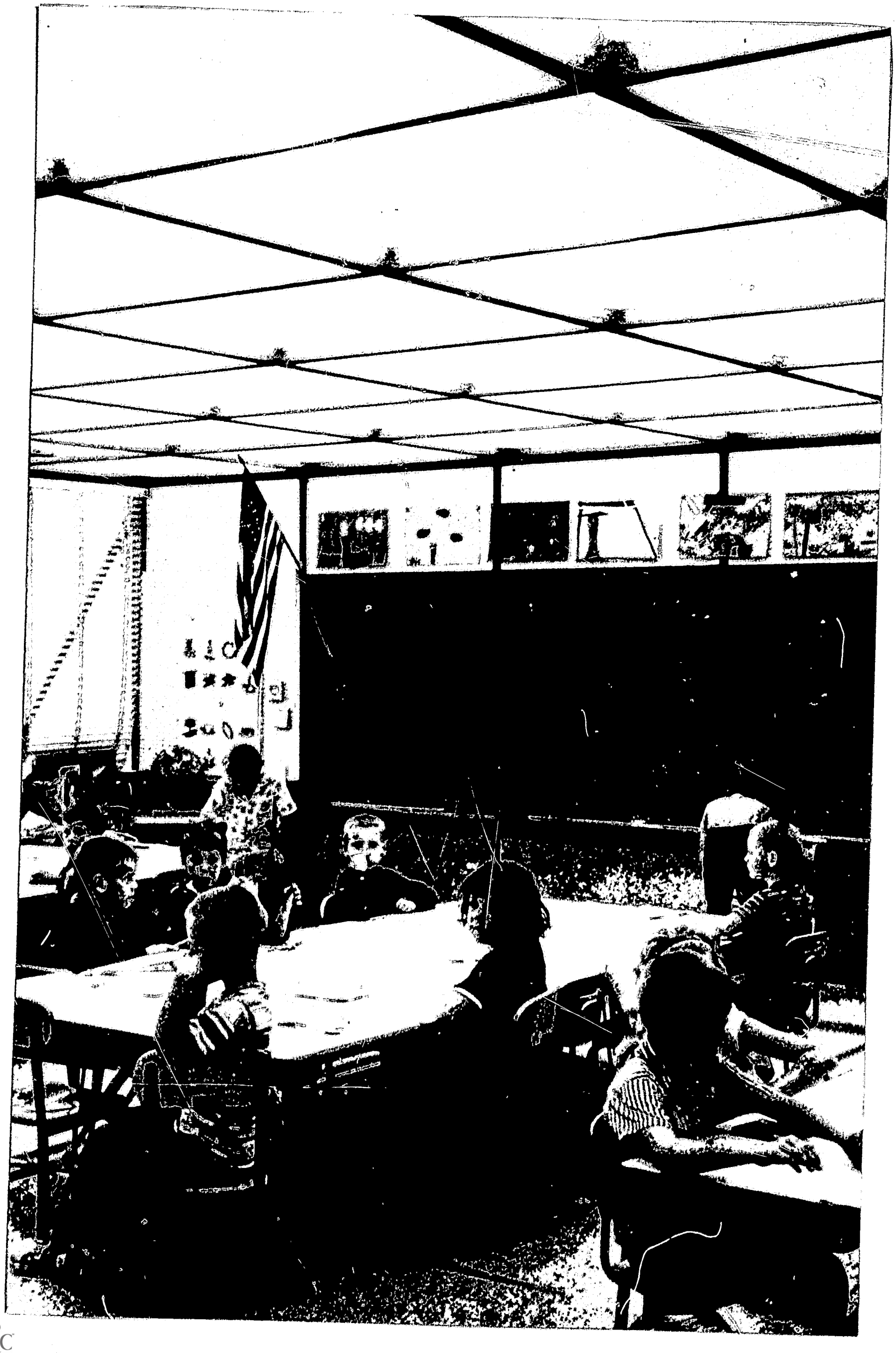
What advice, then, can be given to the school administrator or school architect who may be wondering whether the next schoolhouse to go up in a community should be made windowless?

Etymologically, the term "window" derives from the Old Norse *vindr-auga*, or "wind-eye." The ventilating function has been taken over by the development of mechanical systems that can condition the air in any classroom to any desired degree of freshness and warmth or coolness and to any desired rate of movement. The emphasis on daylighting has likewise been shifted over into new technologies of artificial illumination. If a decision has already been reached that the new school building is to be air-conditioned and the classrooms artifically illuminated, then

the only valid reason for having windows in any classroom is the possibility that an "eye" to the outdoors may be desirable for educational purposes. The educational value of such a view should be assessed against the cost of installing and maintaining classroom windows. If the outside view is unpleasant or potentially disturbing, there seems little point in having any windows at all. On the limited basis of the Hoover School experiment, it is not likely that the children will be adversely affected by a total elimination of the schoolhouse fenestration.

Only the viewing function still continues to keep windows from becoming wholly obsolete technologically, but windows designed solely as "eyes" to the outside environment, if they are to be fully effective, obviously should be quite different in shape and size and location than the traditional window designs. Ideally, they should be ports or apertures in the building shell that will permit the building occupants to have a view of the outside in any desired direction at any desired time. Even scanning devices of the sort used in closed-circuit TV systems conceivably might do the trick.

In short, an entirely new architectural approach to the design of schoolhouse fenestration is called for.

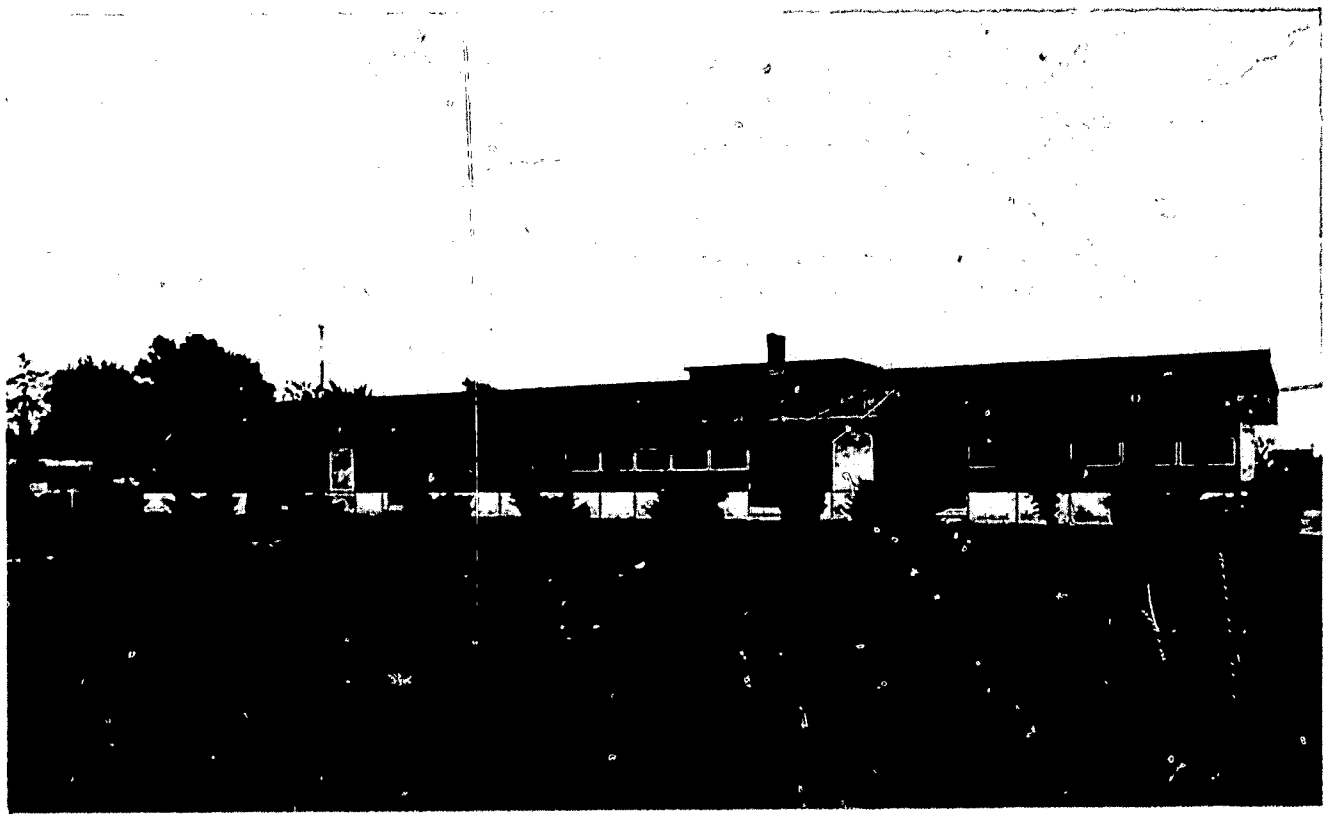


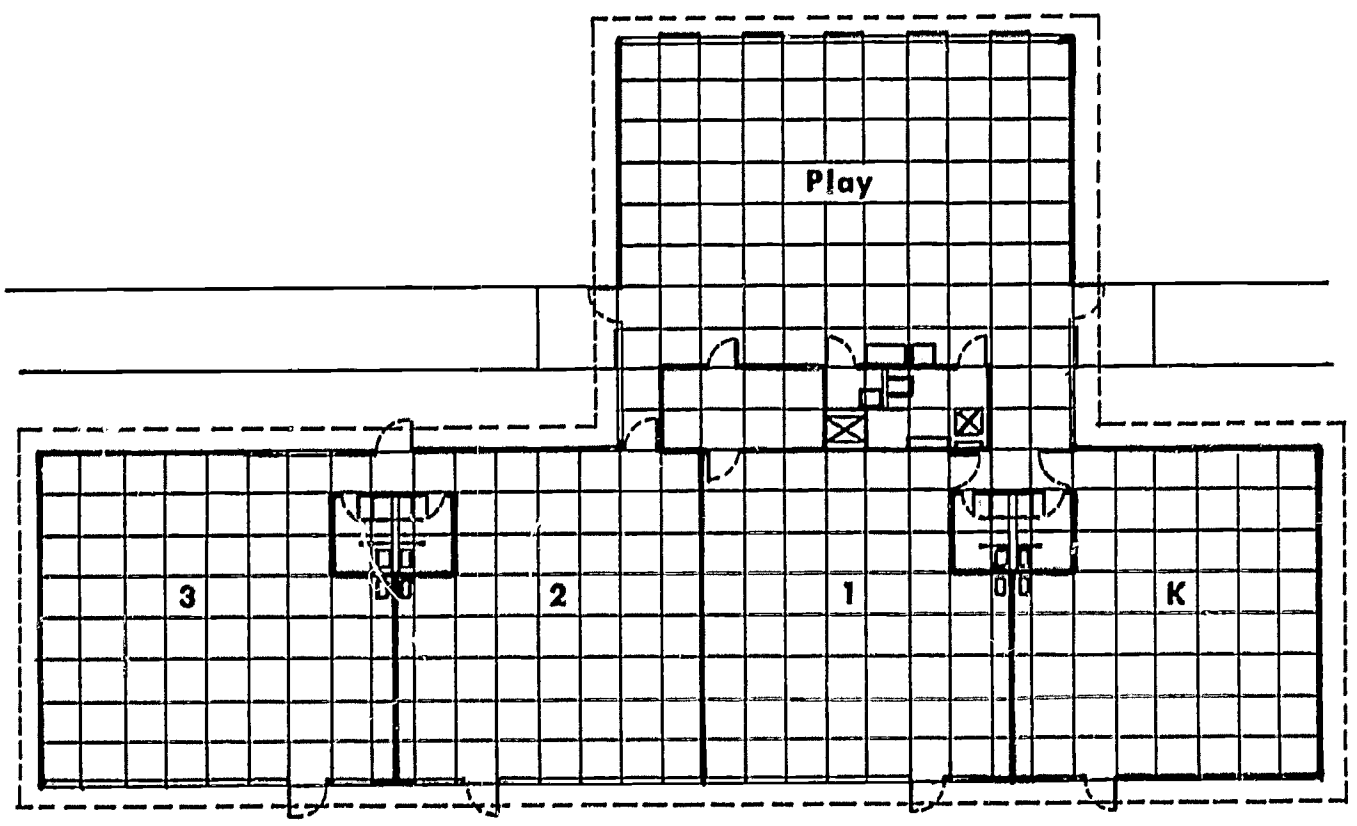
APPENDIX

A

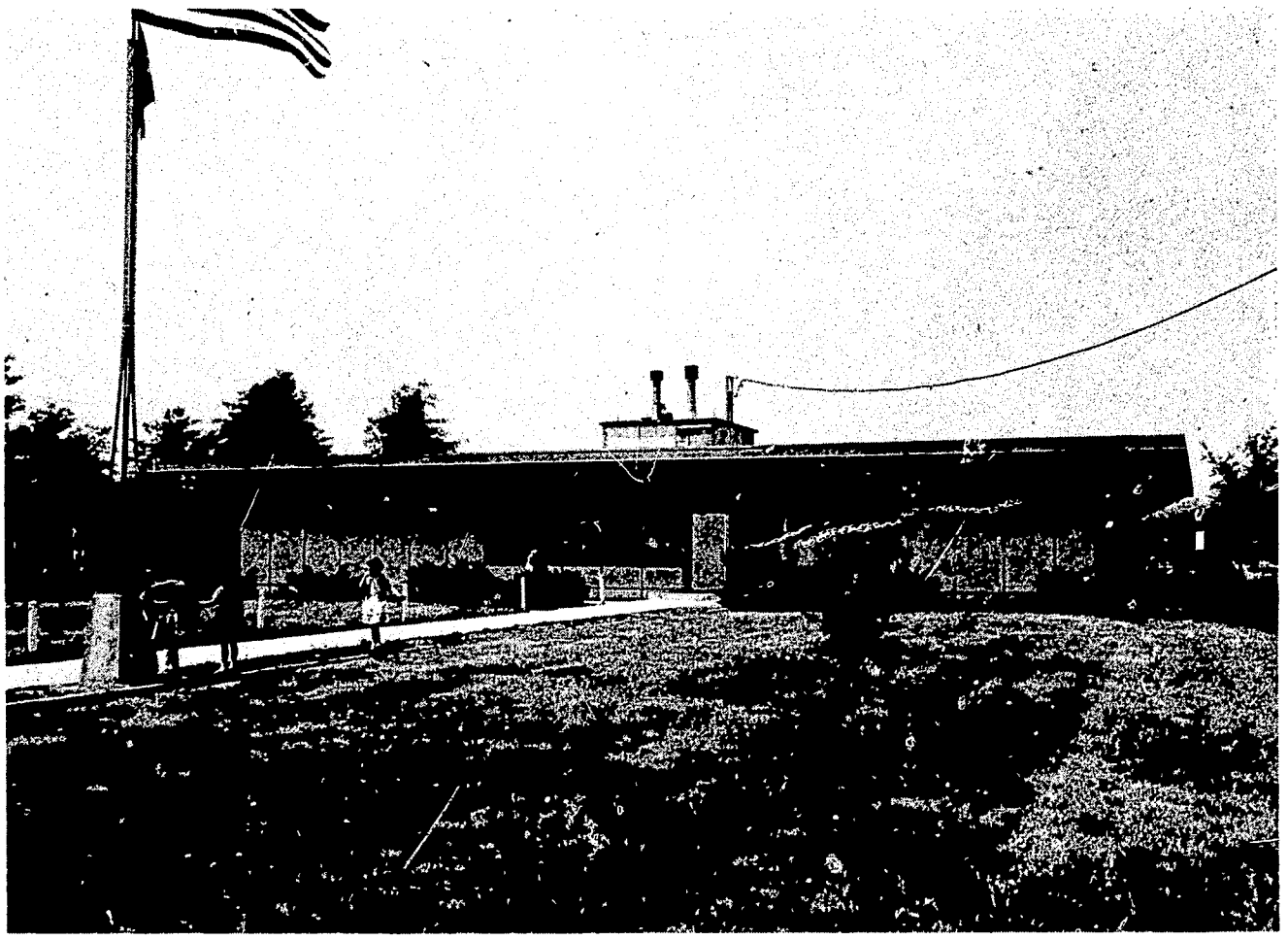
PHOTOGRAPHS AND PLANS OF THE TWO SCHOOLS

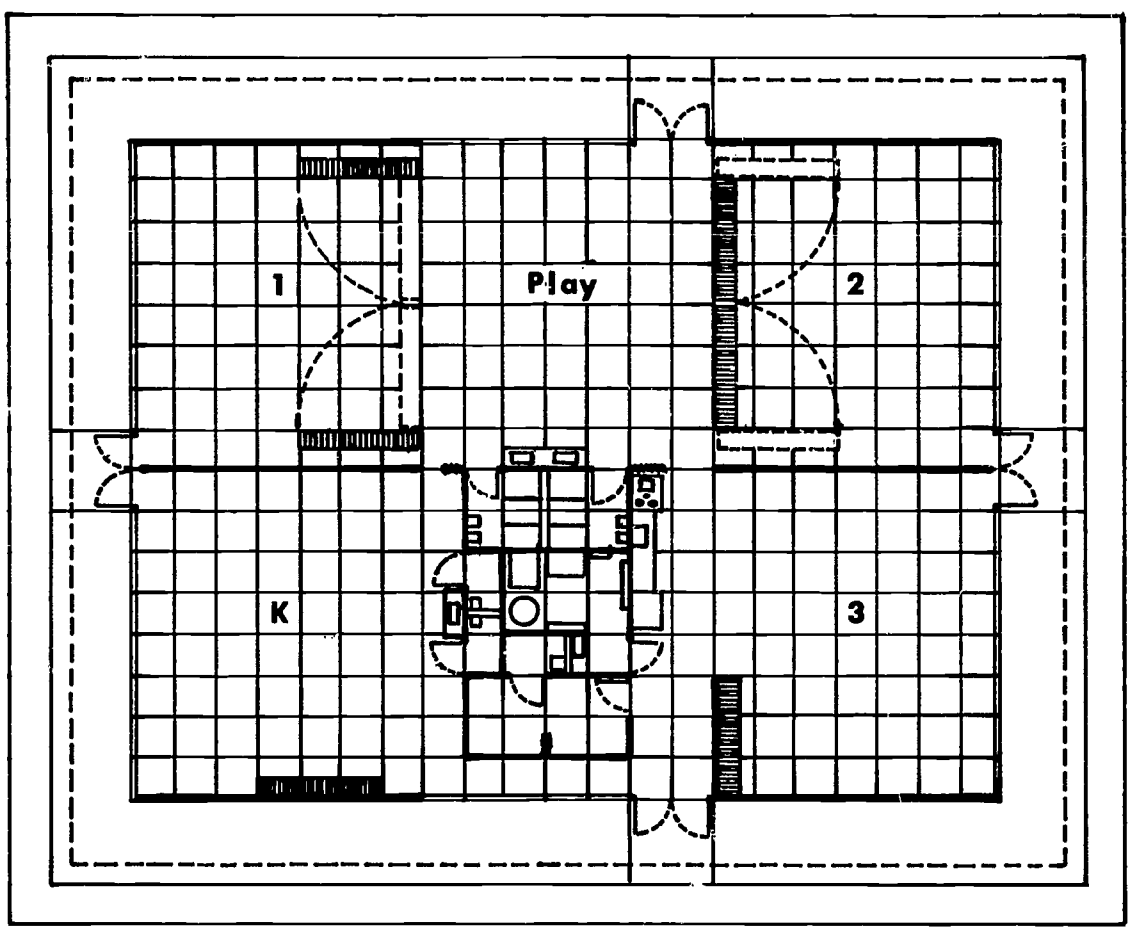
MANN SCHOOL — Exterior View and Plan




Play
3
2
1
K

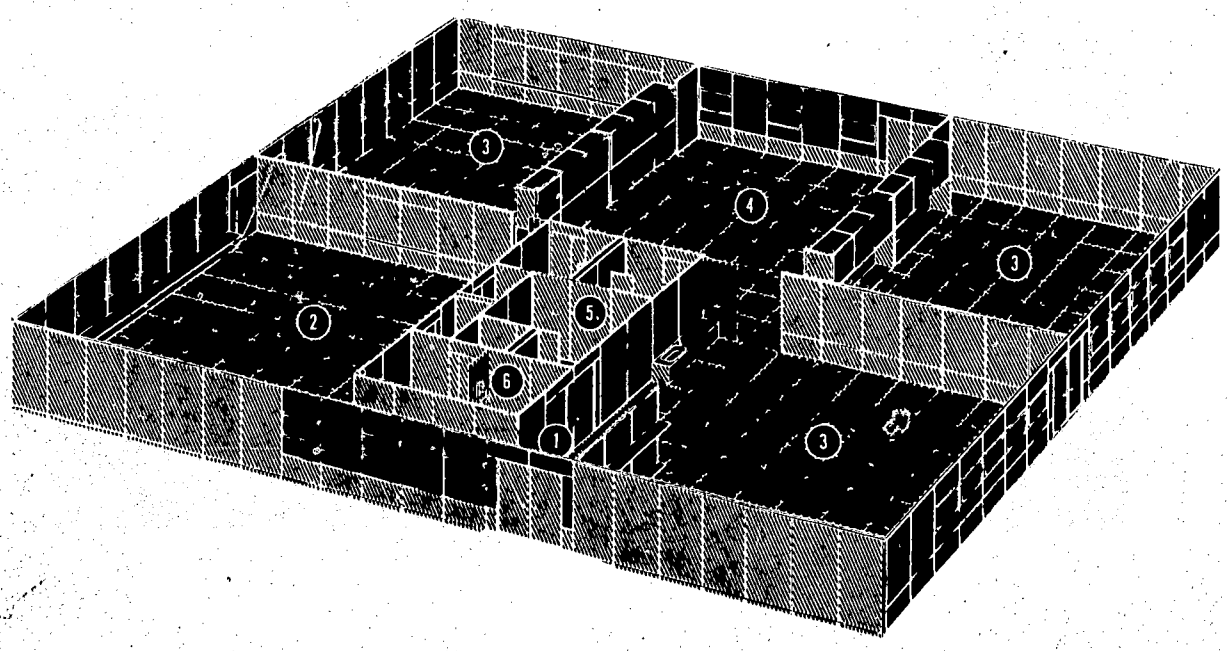
HOOVER SCHOOL — Exterior View and Plan

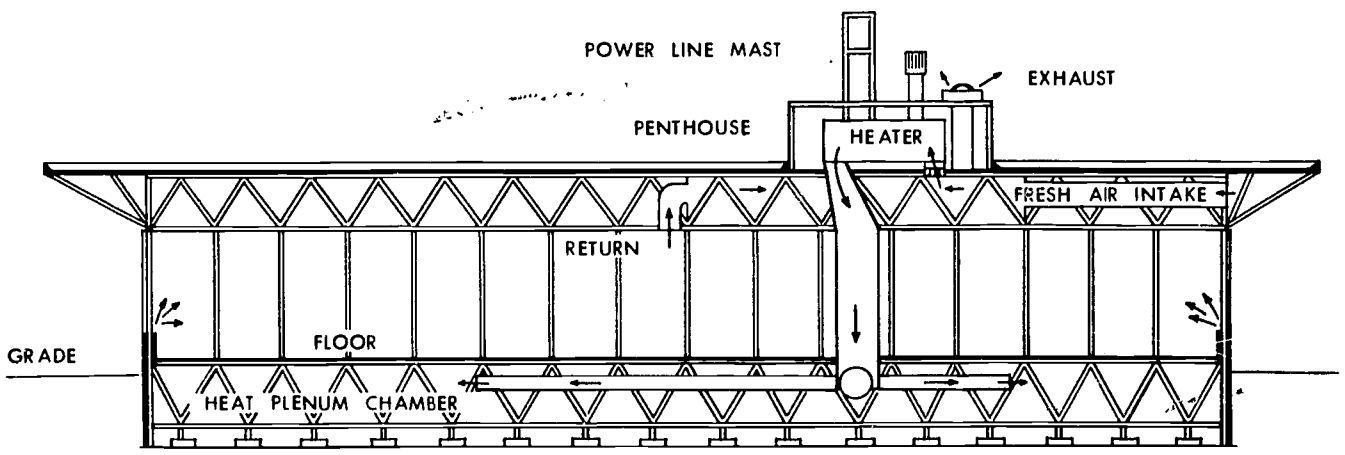



1
Play
2
K
3

HOOVER SCHOOL — Section and Isometric Drawing

1. **Entrance**
2. **Kindergarten**
3. **Classroom**
4. **Multi-purpose room**
5. **Utility room**
6. **Teachers room**



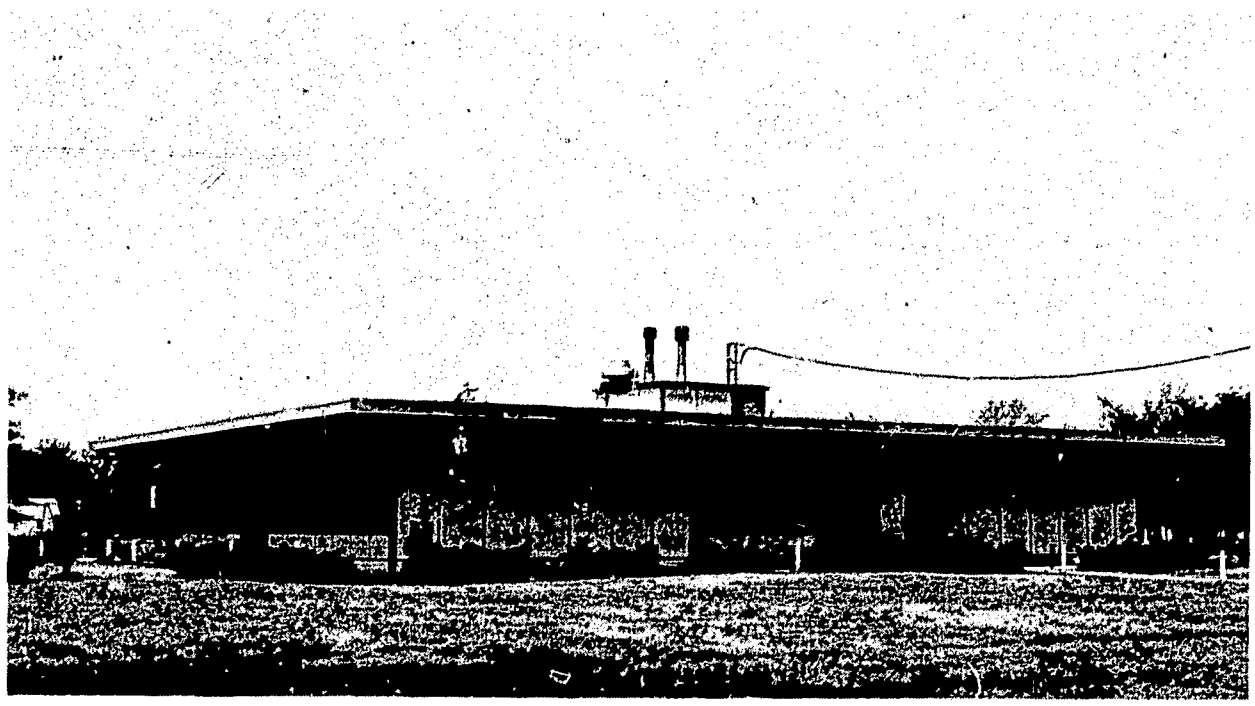


SCALE

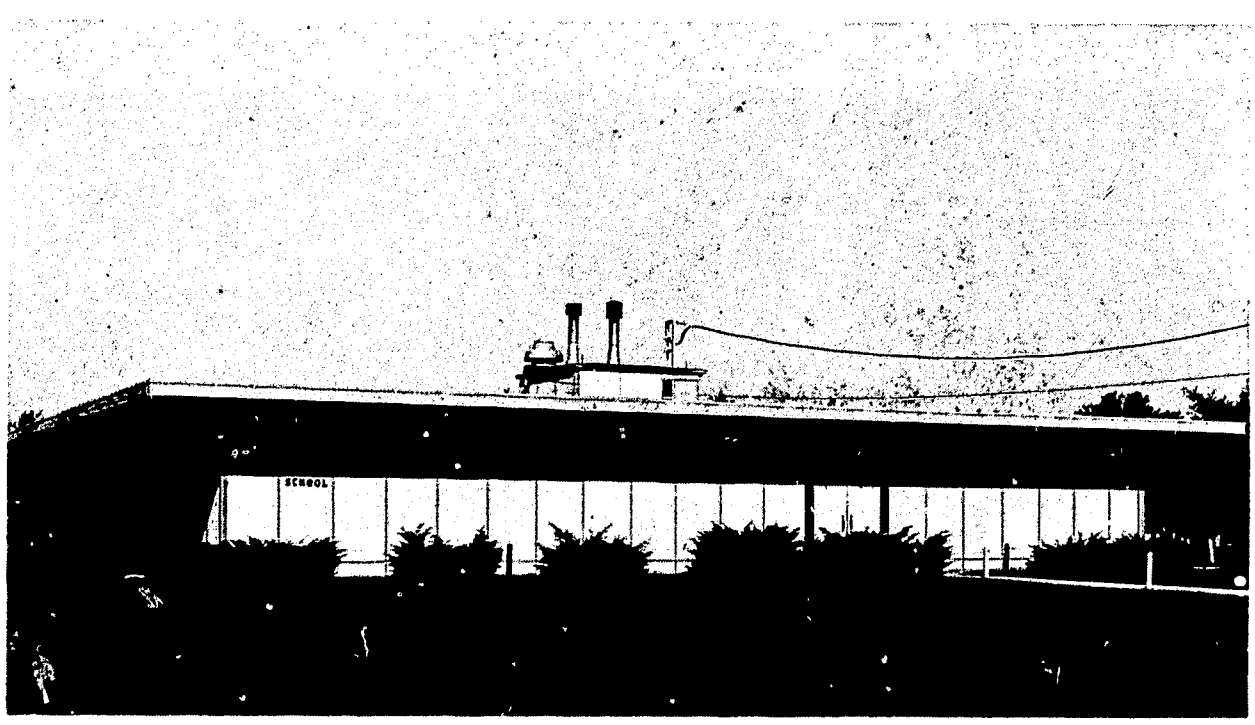
0 4'1" 12'3" 20'5"

SECTION

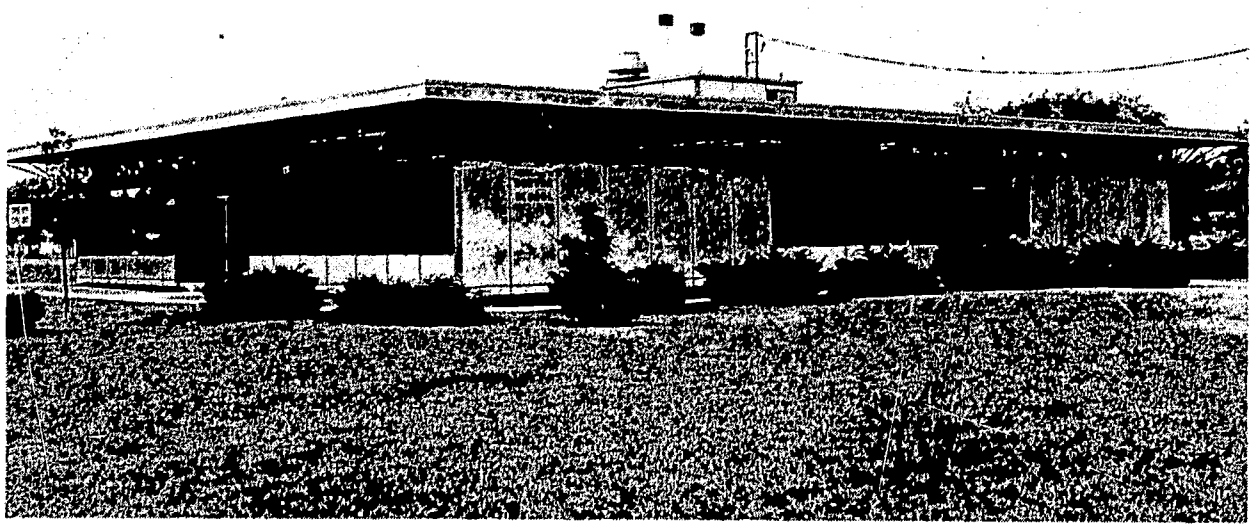
HOOVER SCHOOL — Entrance Facade



Stage 1
With Windows



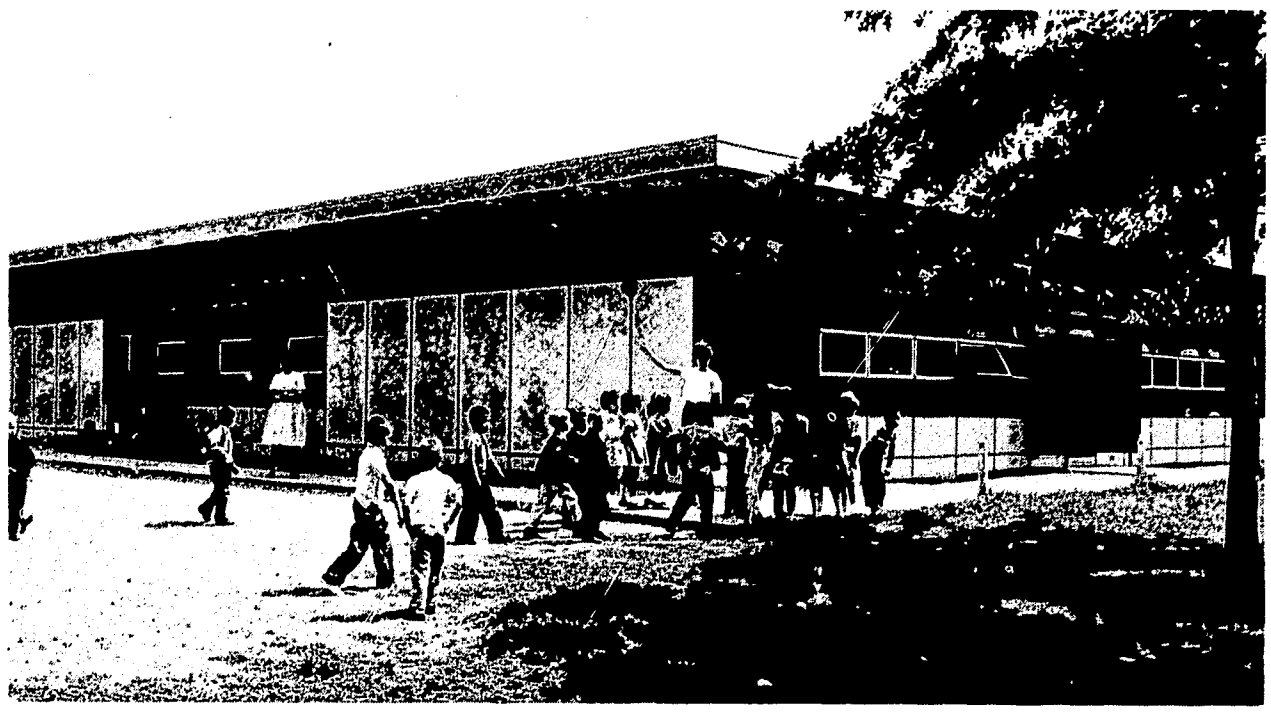
Stage 2
Windows Removed



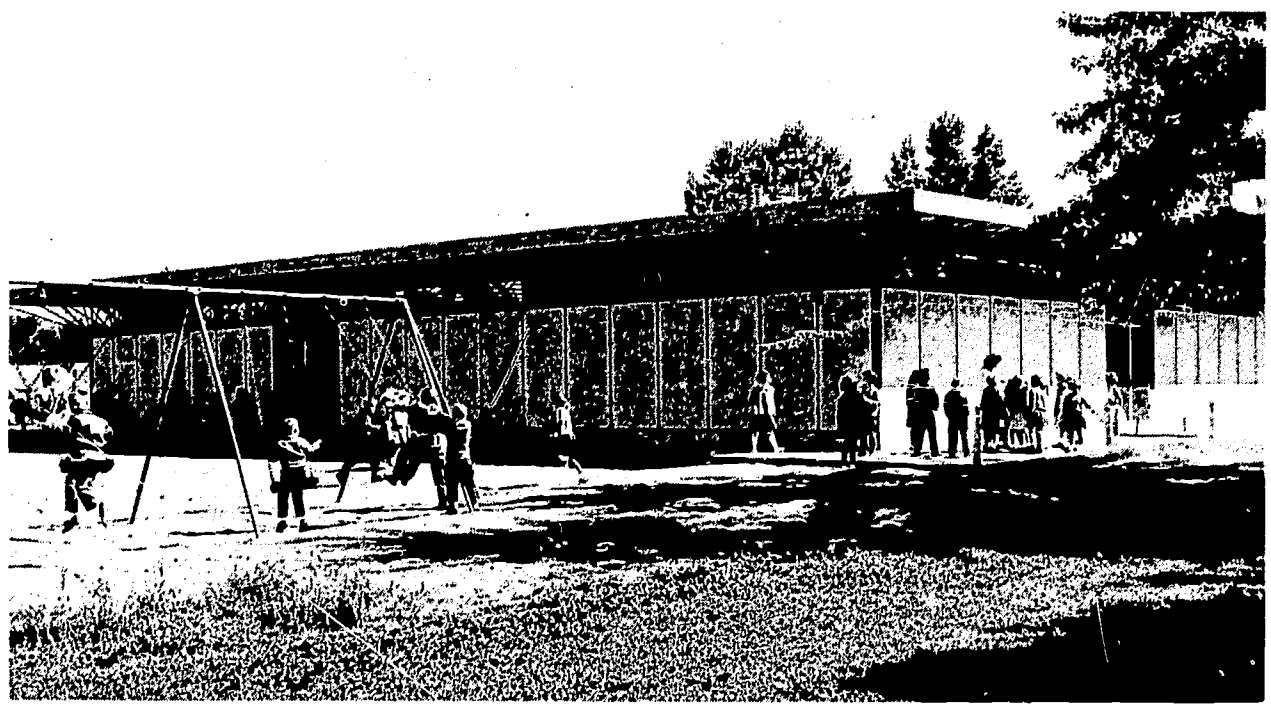
Stage 3
Windows Restored

HOOVER SCHOOL — Playground Facade

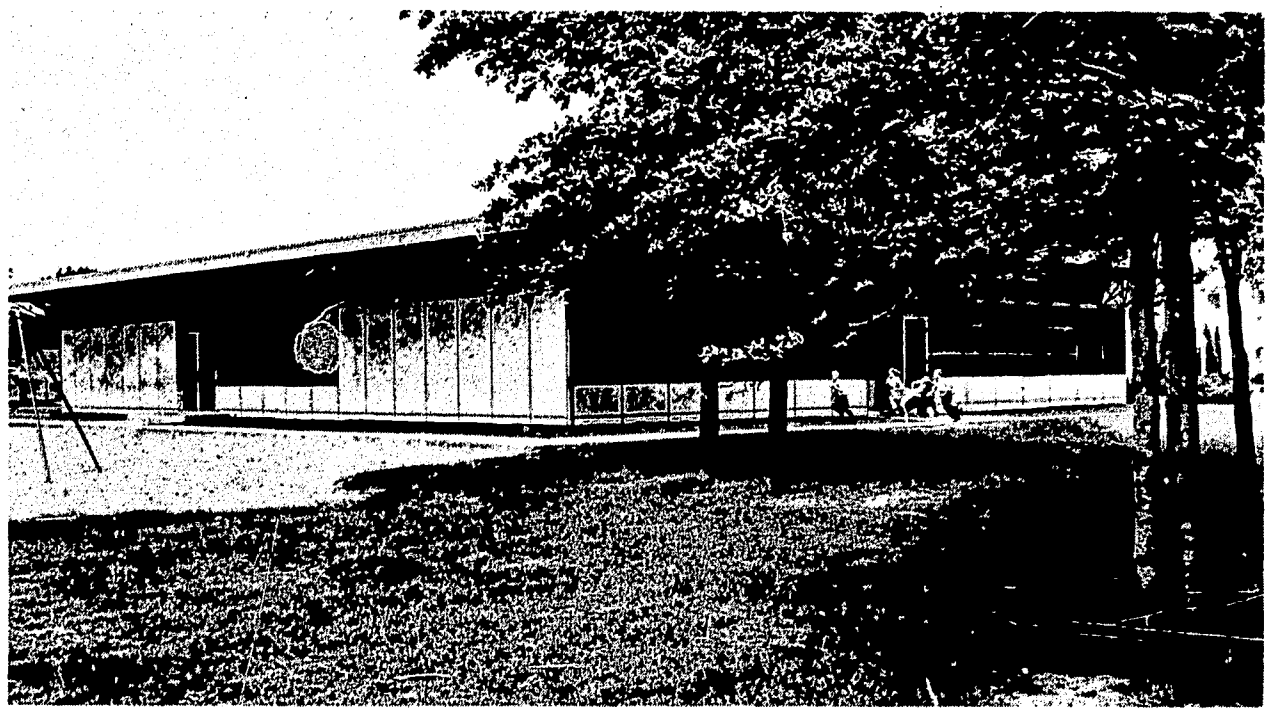
70



Stage 1
With Windows



Stage 2
Windows Removed

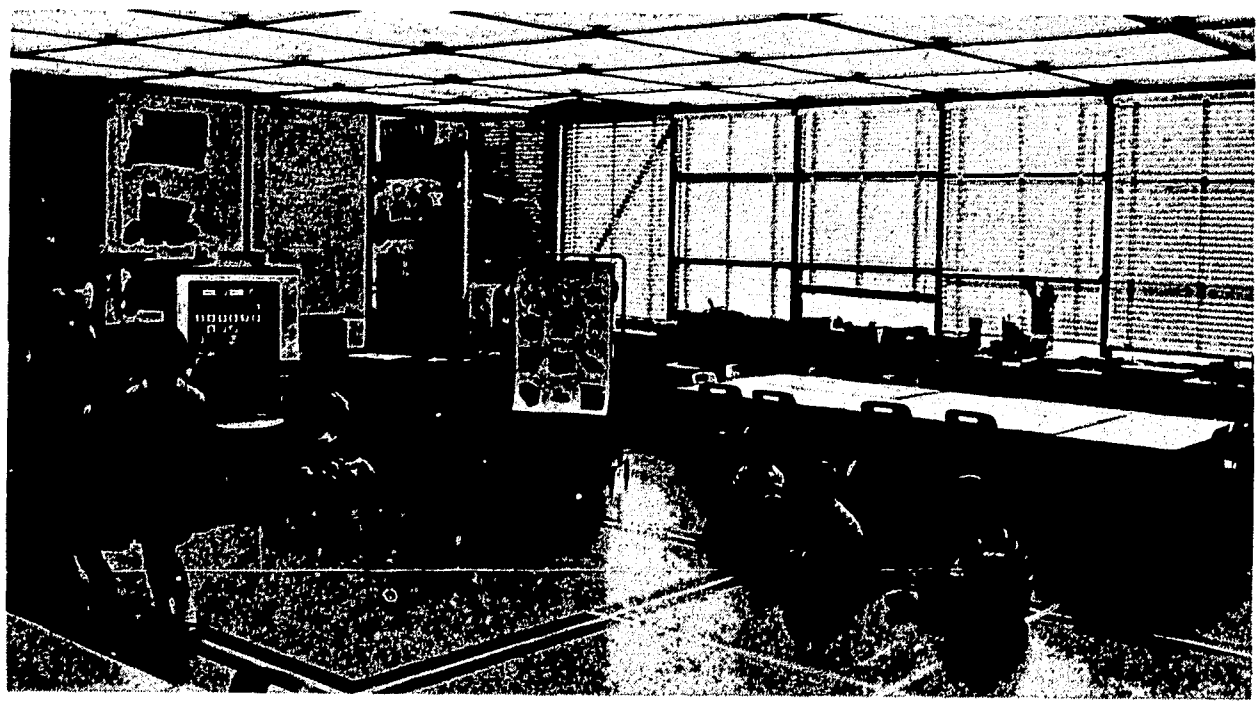


Stage 3
Windows Restored

HOOVER SCHOOL — Kindergarten Classroom

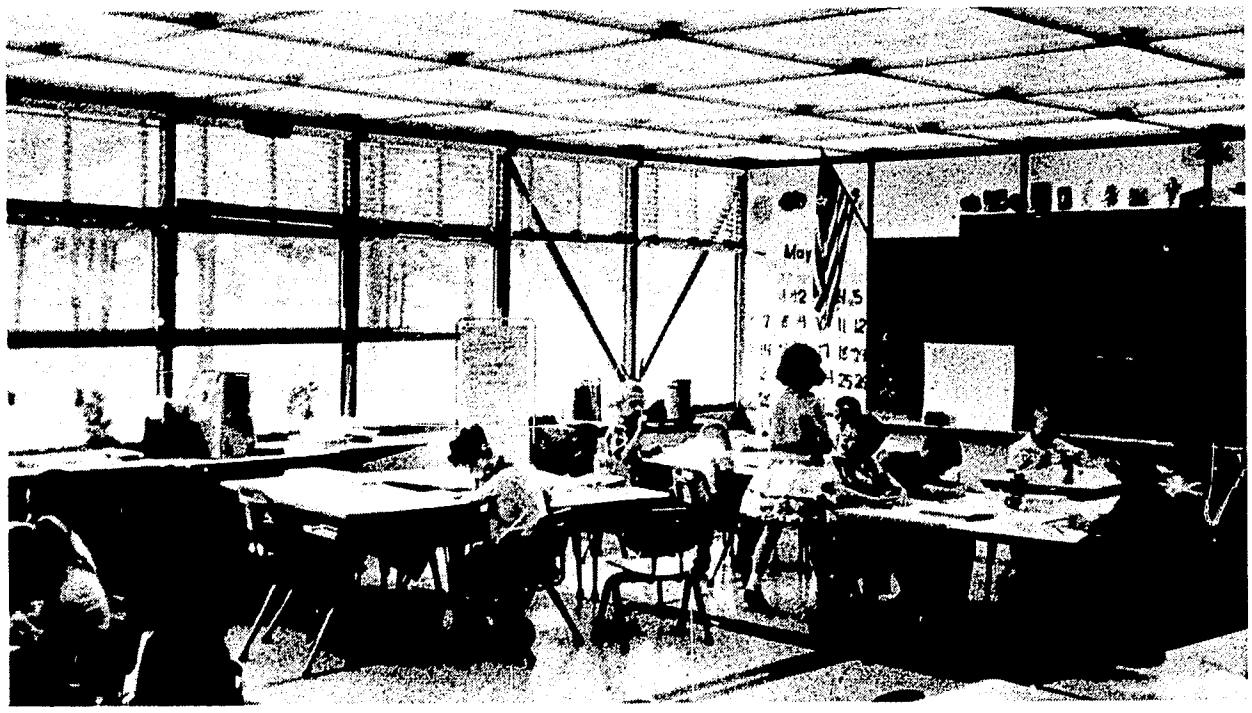
Stage 1
With Windows

Stage 2
Windows Removed

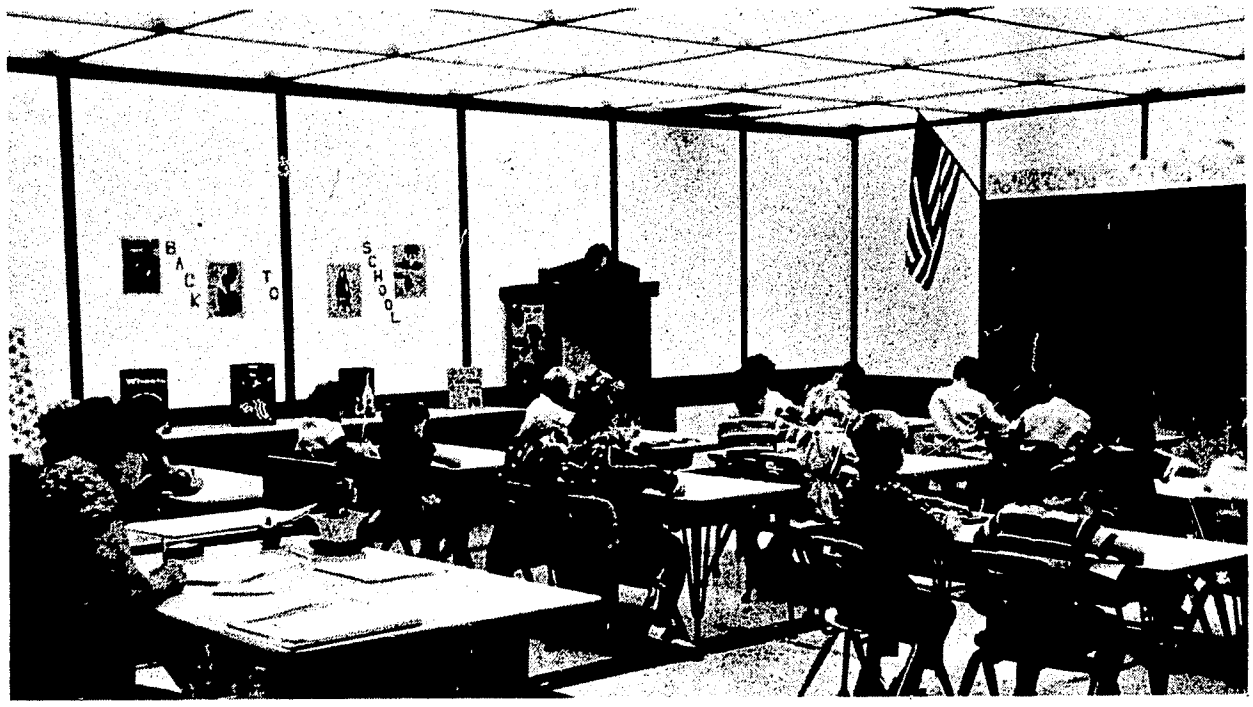


Stage 3
Windows Restored

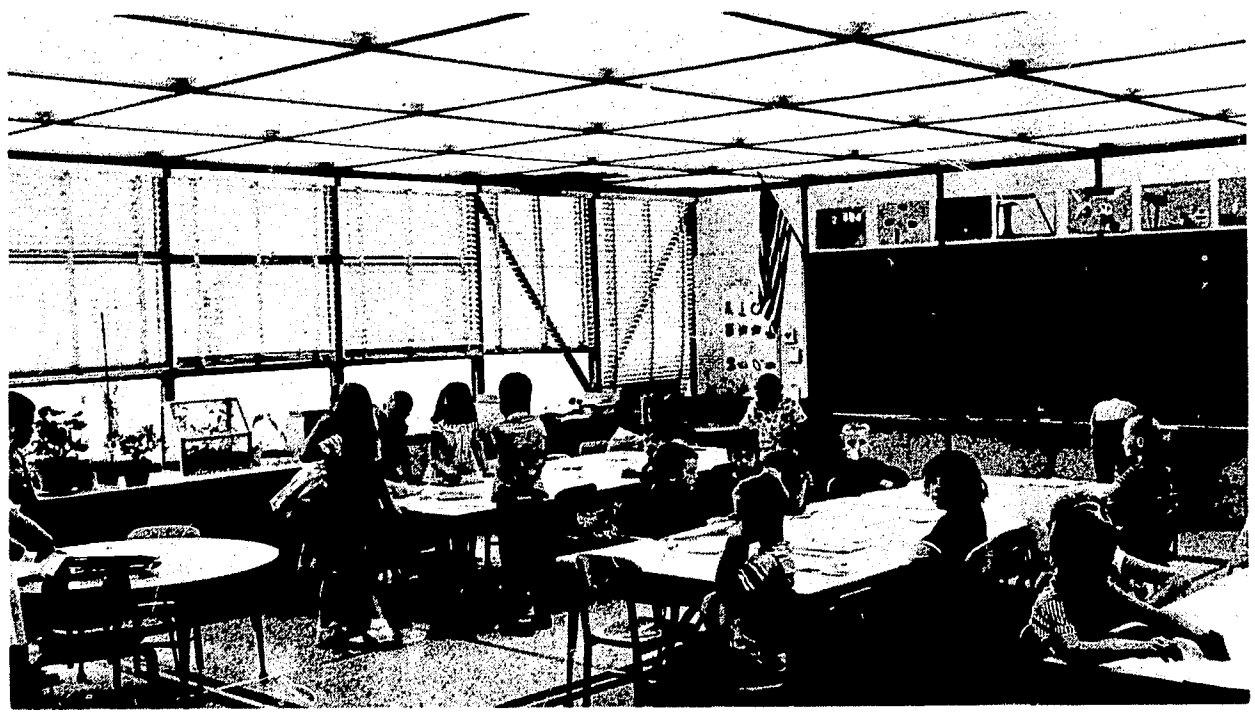
HOOVER SCHOOL — First Grade Classroom



Stage 1
With Windows

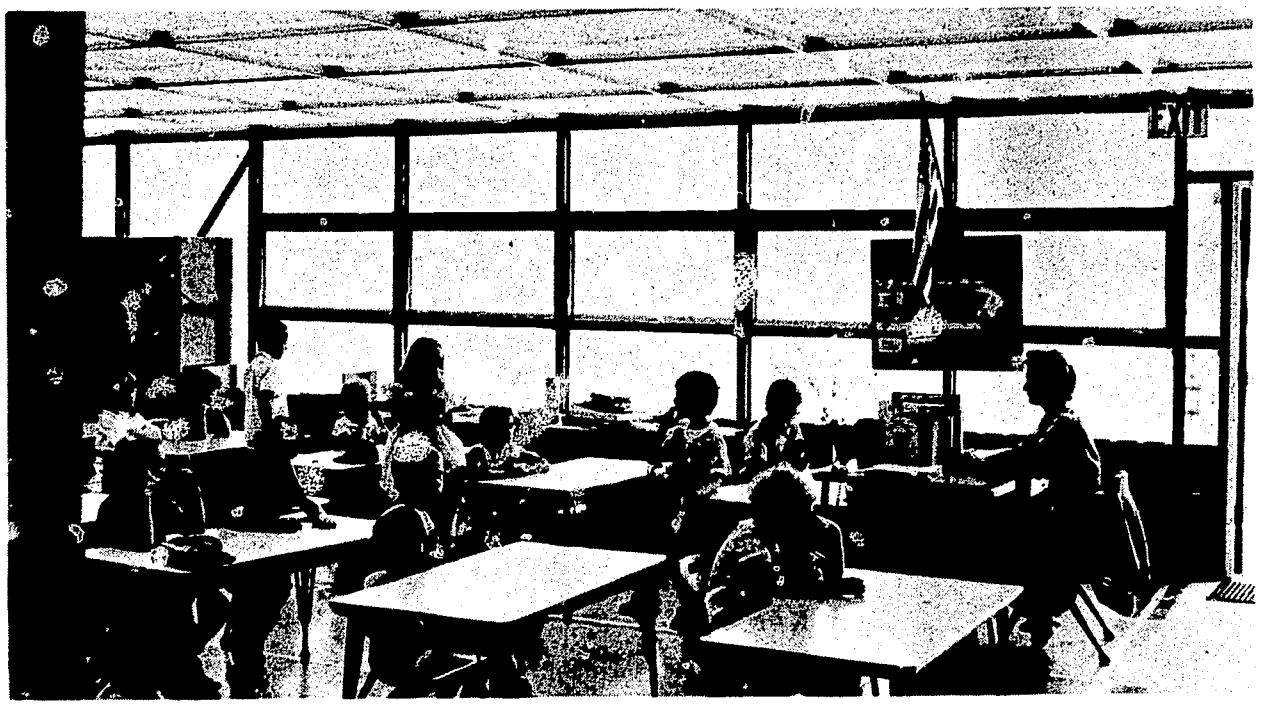


Stage 2
Windows Removed

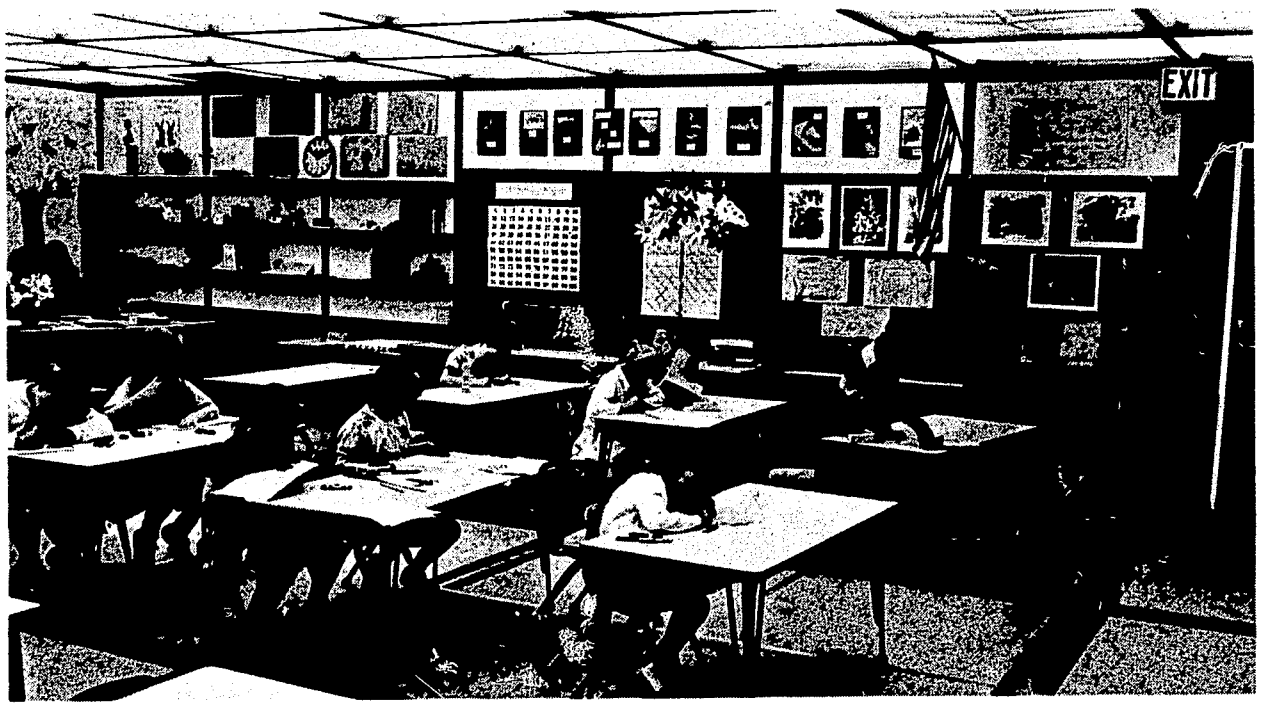


Stage 3
Windows Restored

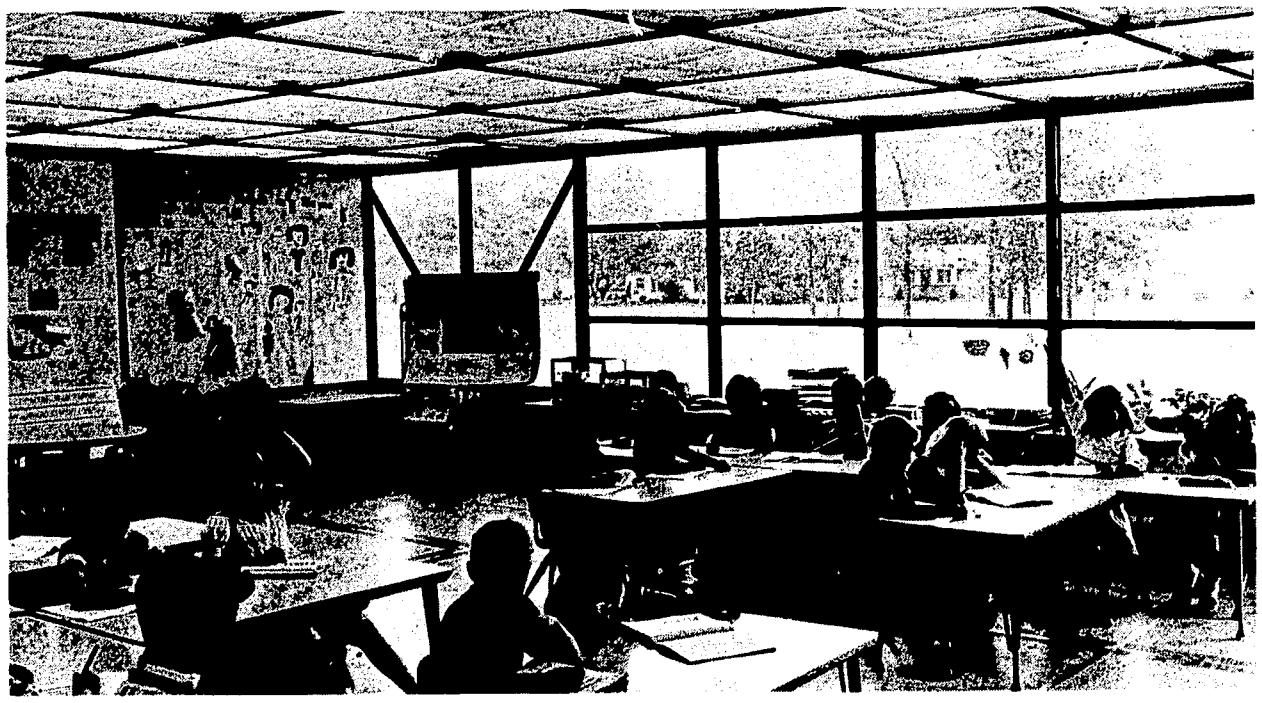
HOOVER SCHOOL — Second Grade Classroom



Stage 1
With Windows

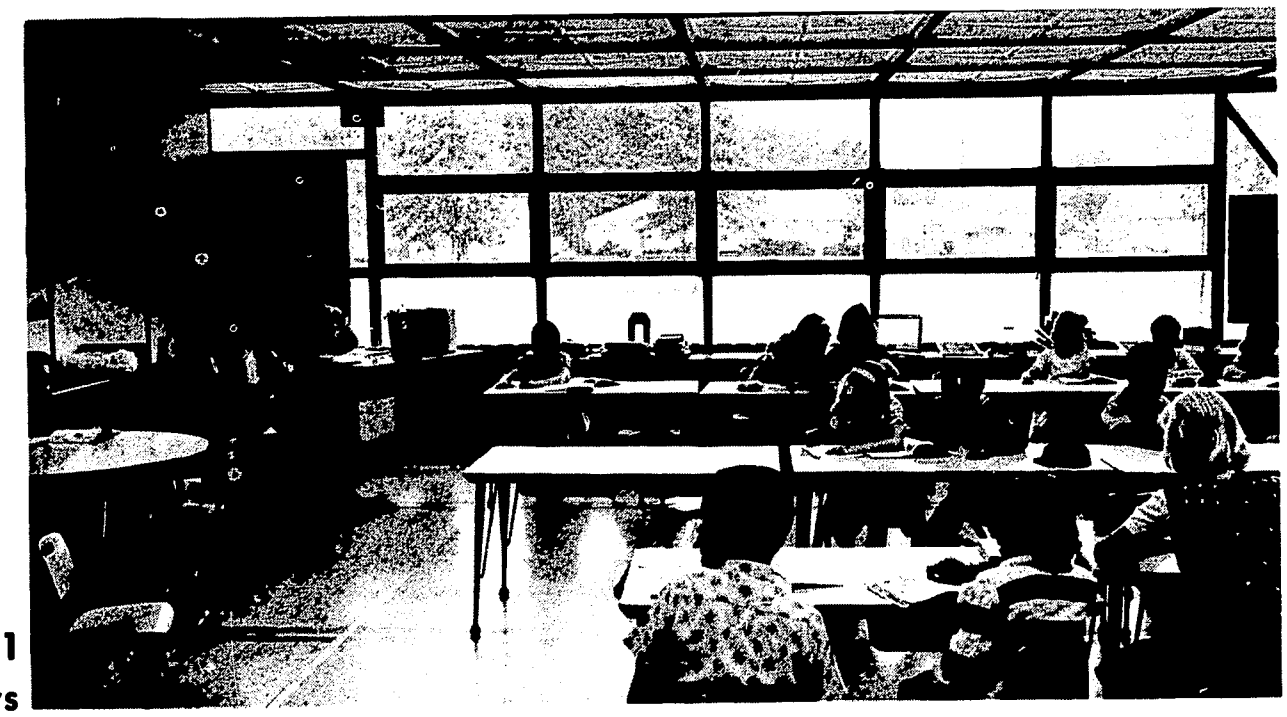


Stage 2
Windows Removed

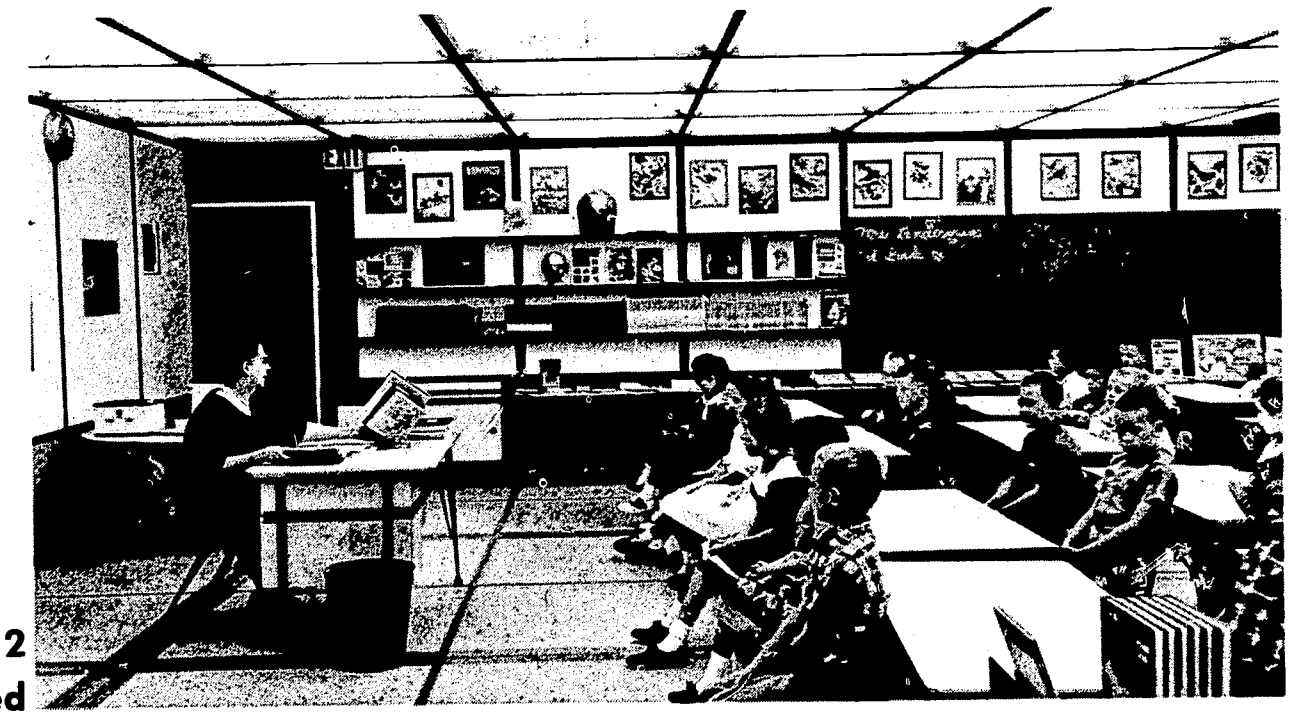


Stage 3
Windows Restored

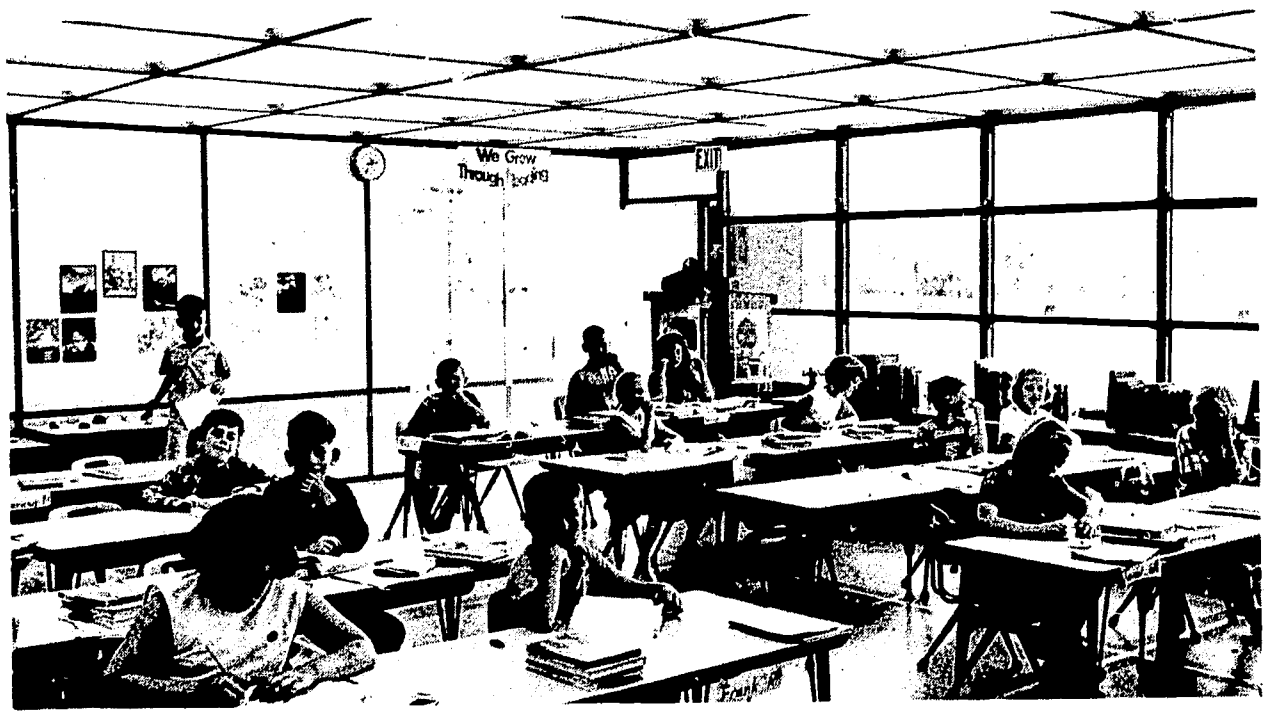
HOOVER SCHOOL — Third Grade Classroom



Stage 1
With Windows



Stage 2
Windows Removed



Stage 3
Windows Restored

APPENDIX

B

PUPIL QUESTIONNAIRE RESPONSES RELATING TO ENVIRONMENTAL FEATURES IN THE HOOVER SCHOOL AT DIFFERENT CASE-STUDY STAGES

analysis by Michael E. Brown

It was assumed that pupils in the Hoover School would be responsive at the beginning of each case-study stage to a number of features in their classroom environments, especially unusual or emphasized ones, and therefore that any general pupil reaction to the removal of windows would be seen in the pattern of questionnaire responses dealing with various features of the environment at different case-study stages.

Table 6 summarizes the responses according to different environmental categories for pupils in the Hoover School. Table 7 does likewise, to a more limited extent, for the Mann School pupils.

In both tables the designated categories involve variables that represent pupil responses to the question asked by the teachers: "What do you like most about your classroom?" Each child was clued, in part, to comment specifically on classroom features rather than on other school children.

As summarized in the two tables, the environmental categories comprise the following:

(1) *Classroom:* responses which refer to the general physical features of the classroom, such as coat rack, study area, science table, color, tables, and the like.

(2) *Windows:* comments relating to the presence or absence of windows and their effects.

(3) *Accessories:* comments which relate to accessory or temporary features of the classroom, such as toys, pictures, maps, flowers, books, and the like.

(4) *Activity:* comments about playing, working, other children, recess, the teacher, pledge of allegiance, singing, and other social doings.

(5) *General:* non-specific comments not easily included in the other categories, such as "don't know", "everything", and the like.

Figure 1, which is based on Table 6, indicates there were more responses of all sorts in Stage 2a, the beginning of the school year in which windows had been removed. This could be because the teachers administering the questionnaires in that stage may have clued students to such responses, but one would expect such clues to occur at all stages. Also, the results do not depend on the number of students in each stage. Since there were 126 students in Stage 1, 144 in Stage 2 and 139 in Stage 3, this in itself would affect the number of responses, but it is not sufficient to explain the pattern of responses. There is not enough difference between the enrollment in the last stage and that in Stage 2 to account for the degree of difference in the responses; and the difference in enrollment between Stage 1 and 2 is not enough to explain the sharp difference in responses between those two stages.

The decline in the number of responses in Stage 2b may indicate some sort of adaptation to environmental conditions and to the novelty of a lack of windows. This would also mean that the Mann School cannot be used as a control for this particular analysis since the control measure was taken only at the end of Stage 2. The lack of any difference in the number of responses between that stage and Stage 3 in the control school is just what might be expected to occur in the experimental school for measures taken at those times if the idea of adaptation is correct.

Figure 2, likewise based on Table 6, presents a complex pattern, one which does not appear to exhibit on the surface any understandable pattern. However, there is some indication here that the pupils made more window-related responses in Stage 2a, the critical stage, than at any other time.

If we overlook Stage 2b, the stage at which adaptation may have occurred, and look only at the other stages where measures were all taken at the beginning of each year, then the results are at least suggestive. Stage 3a is similar to Stage 2a in an important respect, one which suggests that the teachers may have changed techniques in terms of what was required in Stage 2a. (The majority of teachers, it should be noted, were the same in Stages 2 and 3.)

In Stage 1 the general features of the classroom were most noticed, but in Stage 2a the accessory features became important and at the

Table 6 HOOVER SCHOOL PUPIL QUESTIONNAIRE RESPONSES RELATING TO VARIOUS ENVIRONMENTAL FEATURES

Stage 1
With Windows, Spring 1962

	K (a.m.)	K (p.m.)	Grade 1	Grade 2	Grade 3	Total Responses	%
Classroom	12	8	20	26	9	75	54
Windows	0	1	2	1	2	6	4
Accessories	7	11	5	2	5	30	21
Activity	1	0	0	0	0	1	1
General	2	11	6	4	5	28	20
Total	22	31	33	33	21	140	100

Stage 2a
Windows Removed, Fall 1962

Class room	30	8	10	30	16	94	30
Windows	0	0	0	22	3	25	8
Accessories	14	42	15	13	55	139	45
Activity	6	5	7	0	11	29	9
General	16	3	2	4	0	25	8
Total	66	58	34	69	85	312	100

Stage 2b
Windows Removed, Spring 1963

Classroom	12(9)	13(8)	9(11)	12(4)	11(14)	101	45
Windows	0(1)	0(0)	0(1)	0(0)	4(1)	7	3
Accessories	4(8)	6(7)	3(0)	10(0)	10(11)	59	26
Activity	4(2)	1(2)	10(6)	1(0)	0(0)	26	12
General	7(3)	5(2)	0(2)	3(7)	0(2)	31	14
Total	27(23)	25(19)	22(20)	26(9)	25(28)	224	100

Stage 3a
Windows Restored, Fall 1963

Classroom	5	7	4	10	9	35	15
Windows	2	3	1	1	4	11	5
Accessories	39	29	18	6	12	104	45
Activity	10	23	6	0	8	47	20
General	13	5	8	5	3	34	15
Total	69	67	37	22	36	231	100

NOTE: Figures listed under "Total Responses" refer to the total number of responses made by the pupils.
Figures in parentheses refer to responses where pupils indicated what they liked "next best". These figures are included in the main figure for each category.

Table 7 MANN SCHOOL PUPIL QUESTIONNAIRE RESPONSES RELATING TO VARIOUS ENVIRONMENTAL FEATURES

Stage 2
Windows Removed, Fall 1962 to Spring 1963

	K (a.m.)	K (p.m.)	Grade 1	Grade 2	Grade 3	Total Responses	%
Classroom	4	1	2	0	19	26	17
Windows	0	1	0	0	2	3	2
Accessories	8	1	0	0	2	3	2
Activity	6	8	8	21	0	43	28
General	8	5	0	6	3	22	14
Total	26	28	28	30	43	155	100

Stage 3
Windows Restored, Fall 1963 to Spring 1964

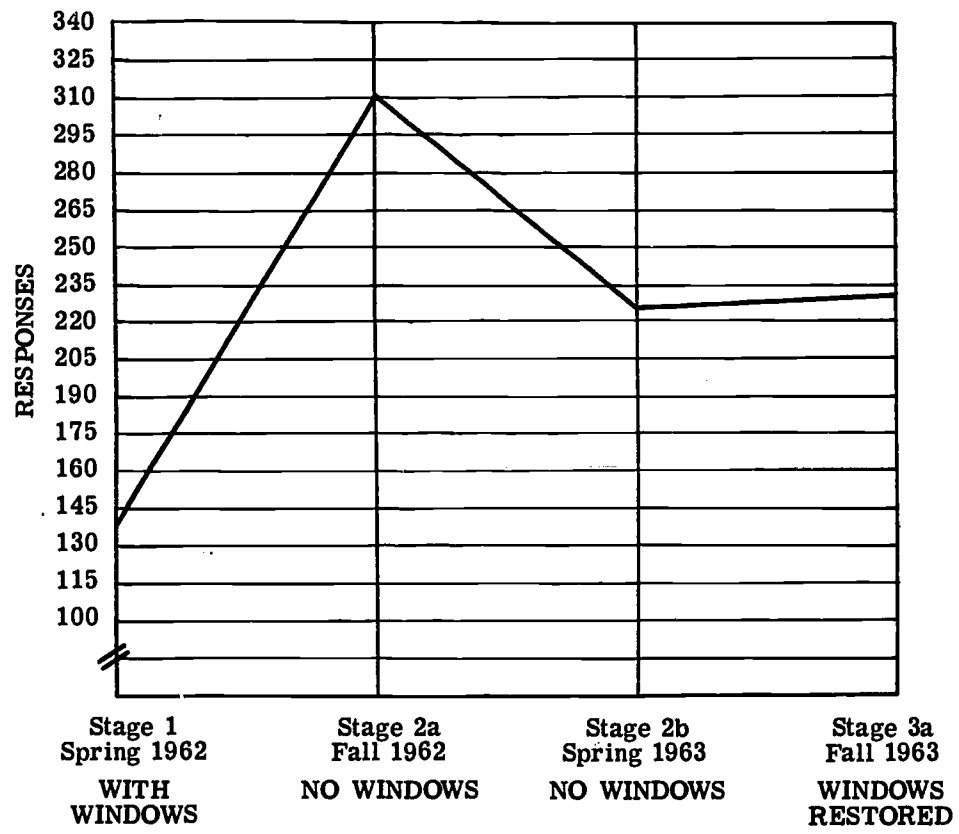
Classroom	1	1	10	11	7	30	22
Windows	0	0	0	0	0	0	0
Accessories	16	9	12	11	10	58	42
Activity	10	12	7	0	1	30	22
General	2	2	10	0	7	21	14
Total	29	24	39	22	25	139	100

same time there was an increased emphasis on social factors and activity. Perhaps the lack of windows led to an initial emphasis on resources within the classroom. During the course of the year, however, the new practices lost their novelty and were then taken for granted. The most obvious and accessible visual features of the classroom once again took precedence.

In Stage 3a the new practices might again have been highly noticeable as the new school year began. This is reflected in the increased number of responses to accessories and social-activity factors, and the decreased response to general features of the classroom. Thus, if measures were to be taken at the end of Stage 3, one would expect a pattern similar to that of Stage 1 and 2b.

Figure 1

HOOVER SCHOOL—TOTAL NUMBER OF PUPIL RESPONSES TO ALL FEATURES OF ENVIRONMENT. (See Table 1)



Very simply, the order of noticeability for the three stages in question is the following:

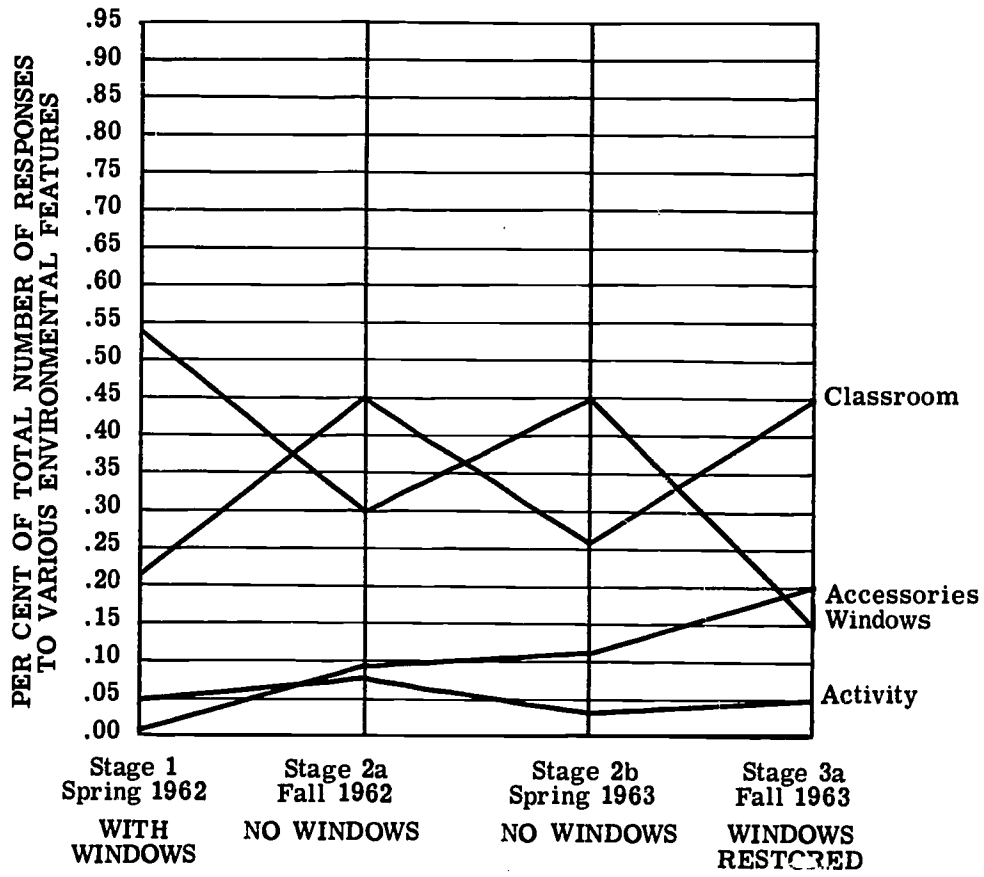
Stage 1 WITH WINDOWS	Stage 2a WINDOWS REMOVED Fall 1962	Stage 3a WINDOWS RESTORED Fall 1963
Classroom features	Accessories	Accessories
Accessories	Classroom features	Social activity
Windows	Social activity	Classroom features
Social activity	Windows	Windows

These results could be because the teachers clued students to the appropriate responses. Such an interpretation is supported by the fact that the order is different in the Mann School. Also, the results could be due to changes in teacher practices and class behavior effected in part by the removal of windows in Stage 2.

Apparently it is only in the initial part of each stage that pupil responses are sensitive to any novelty in teacher practices or environmental

Figure 2

HOOVER SCHOOL—PER CENT OF PUPIL RESPONSES FAVORABLE TO VARIOUS FEATURES OF THE ENVIRONMENT FOR ALL CLASSES AS A GROUP. (See Table 1)



features. Although there is some indication of a Hawthorne effect, as suggested by the fact that Stage 2b resembles Stage 1, in the light of all the other results it may be a response to conditions which are in some ways dependent on the removal of the windows and which seem to be related to aspects of pupil performance.

APPENDIX

C

TEACHER EVALUATIONS OF THE LEARNING PERFORMANCE OF PUPILS IN THE HOOVER SCHOOL AT DIFFERENT CASE-STUDY STAGES

analysis by Michael E. Brown

It was assumed that the removal of windows in the Hoover School would affect all classes insofar as grading (teacher evaluation of the learning performance of individual pupils) was concerned, and that the effect would be greater for the less task-oriented groups (first graders), smaller for the next in degree of task-orientation (second graders), and smallest for the class with the highest degree of task-orientation (the third graders).

Thus, in a group that is not task-oriented, such as kindergarten, the removal of windows is tantamount to the removal of an important resource for stimulating pupil interest and activity, whereas in the task-oriented classes, the removal of windows should provide far less distraction (a fact testified to by the teachers involved) and a devotion of energy to things more related to the classroom and the task at hand. In such a case, it could be argued that there will be a greater spirit of participation among the students, and a greater willingness on the part of teachers to employ different and more interesting practices (this is supported by the fact that the teachers tried in different ways to use the added wall space provided by the removal of windows, and the fact that students appeared to notice and approve of this).

For this reason, teacher grading of individual pupil performance has been considered important for the first graders, second graders, and third graders but not for the kindergartners. In the following analysis, therefore, only the evaluations for the first, second, and third grade classes are used.

In the preparation of Tables 8 and 9, the following definitions were established for the various variables:

(1) *Grade:* Individual evaluations by teachers of pupil performance in several component items—reading, writing, spelling, arithmetic, and art work. Thus, there is a score for each item, and a total score for all items.

(2) *Average grade per item:* The group average of each individual pupil's average grade per item.

(3) *Average grade for all items:* The group average of each individual pupil's total grade for all items, with the result being corrected for differences in the number of items comprising the total. This permits a comparison among classes.

(4) *Average amount of variation in grades:* The average amount by which individual pupil grades differed from the average grade for their class, set of classes, or case-study stage.

Figures 3 and 4, which are based on Table 8, are not clear as to the effects of Stage 2. It is tempting, however, to point to the following trend: Stage 2 is accompanied by wider differences among the classes, and the amount of change is directly related to the advancement of the class. The first grade is most changed, the second grade is next, and the third grade is least changed. Furthermore, there is some suggestion

Table 8

AVERAGE GRADE (PUPIL EVALUATION) FOR THREE STAGES ON A 20-POINT SCALE COMPOSED OF SEVERAL ITEMS (CORRECTED FOR THE NUMBER OF COMPONENT ITEMS); AND AVERAGE GRADE PER ITEM ON A 4-POINT SCALE; FOR FIRST GRADE, SECOND GRADE, AND THIRD GRADE CLASSES IN THE HOOVER SCHOOL

	Stage 1 WITH WINDOWS	Stage 2 WINDOWS REMOVED	Stage 3 WINDOWS RESTORED	
Average/Item	3.0	3.4	2.9	FIRST GRADE
Average	15.2	16.7	14.5	
Average/Item	2.8	2.8	2.8	SECOND GRADE
Average	14.2	14.1	13.9	
Average/Item	2.9	3.0	3.0	THIRD GRADE
Average	14.3	15.0	15.2	

Table 9

AVERAGE AMOUNT BY WHICH GRADES FOR INDIVIDUAL PUPILS VARY FROM THE AVERAGE GRADE FOR EACH CLASS IN THE HOOVER SCHOOL

	Stage 1 WITH WINDOWS	Stage 2 WINDOWS REMOVED	Stage 3 WINDOWS RESTORED	
Average Variation	2.40	1.80	1.92	FIRST GRADE
Average Variation	.96	.90	1.53	SECOND GRADE
Average Variation	.95	2.00	1.72	THIRD GRADE

of a reversal in the trend for Stage 3. Thus, there is no appreciable change in the average pupil evaluation for the third grade during the three stages; there is some change for the second grade in Stage 2, a change which also appears in Stage 3, but to a lesser extent; and the first grade shows a sharp change and return in Stages 2 and 3.

Table 10 indicates that if we divide the pupil scores into high and low, Stage 2 is characterized by a considerably smaller percentage of pupils with high evaluations (above the average for the class). Although 61%

Figure 3

AVERAGE GRADE FOR THREE STAGES ON A 4-POINT SCALE FOR A SINGLE ITEM, FOR THE FIRST, SECOND AND THIRD GRADE CLASSES IN THE HOOVER SCHOOL.

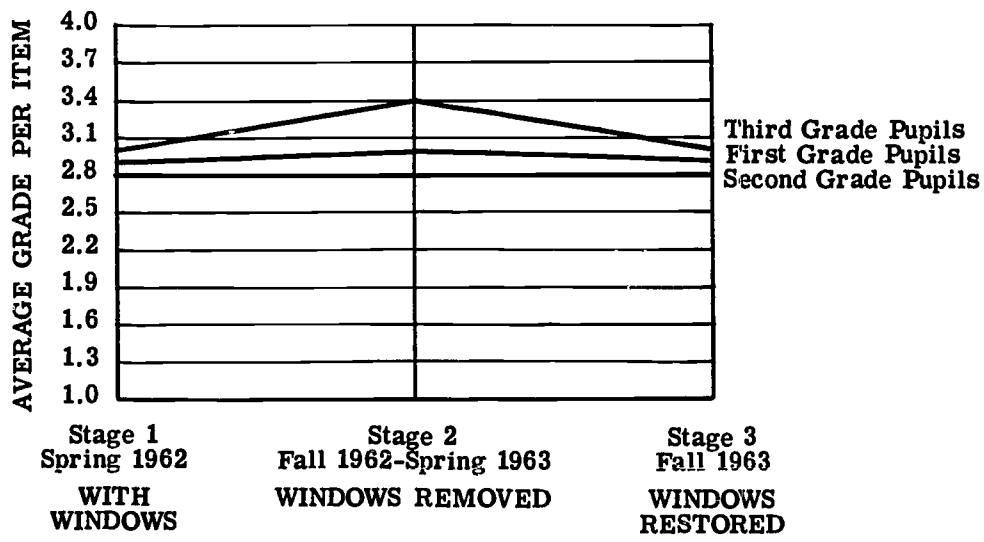
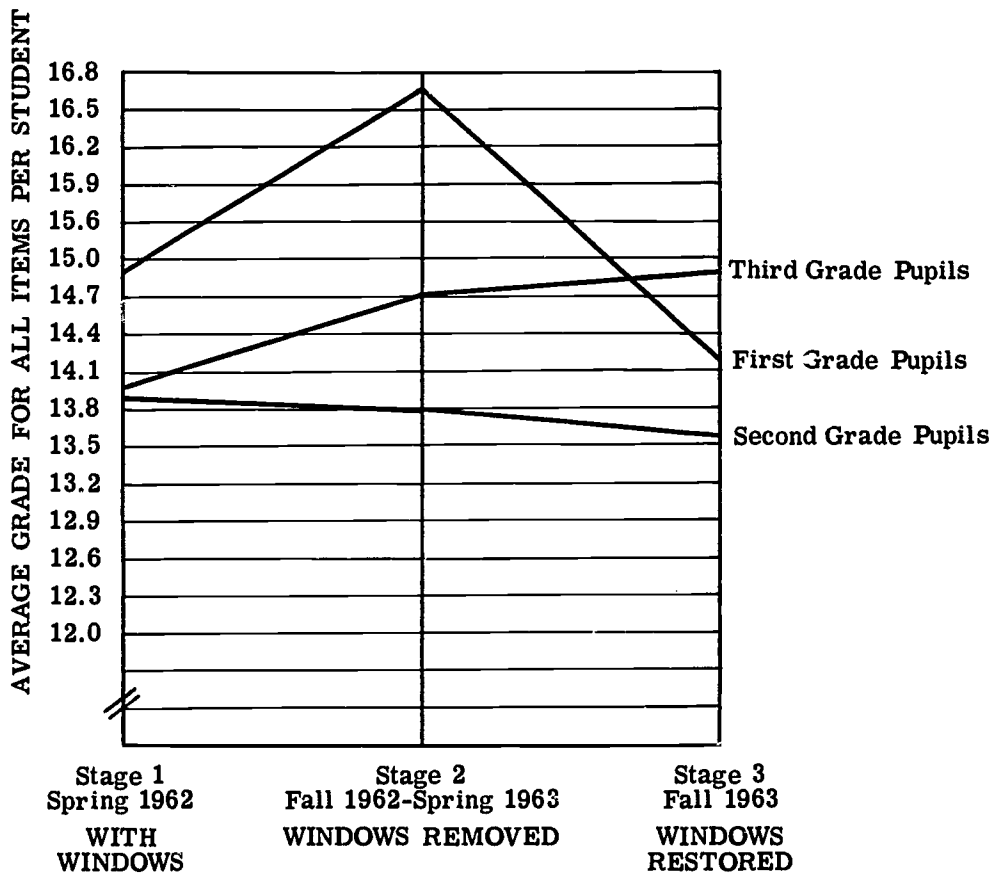


Figure 4

AVERAGE GRADE FOR THREE STAGES ON A 20-POINT SCALE, FOR ALL COMPONENT ITEMS, FOR THE FIRST, SECOND AND THIRD GRADE CLASSES IN THE HOOVER SCHOOL.



and 56% respectively of the pupils achieved high scores in Stages 1 and 3, only 42% achieved high scores in Stage 2. Apparently these results are independent of the sex of the students: girl pupils invariably received higher evaluations in each stage, but the same trend also applied to the boys.

One might suppose that the different stages could be characterized by predictable shifts in the amount of variance among the evaluations of any particular class, especially in the classes high on task orientation (e.g., third grade). If the removal of windows serves to force pressures within a task-oriented group toward task behavior and group functioning, it seems reasonable to expect more homogeneity with respect to performance. But Figure 3 suggests that the variance does not follow a pattern which is either predictable in terms of the previous discussion or which serves to explain the results already noted. The pattern illustrated by Figure 5 is apparently not explainable in terms of the environmental manipulation in Stage 2, nor in terms of shifts of teacher evaluation habits: the same teachers were in the first and second grades for both Stage 2 and Stage 3, but the variance seems to change independently.

Table 10 CHANGES IN GRADES FOR THREE STAGES, CONTROLLING FOR SEX, AND DIVIDING GRADES (SCORES) INTO HIGH AND LOW (ABOVE AND BELOW THE AVERAGE), FOR THE FIRST, SECOND, AND THIRD GRADES IN THE HOOVER SCHOOL

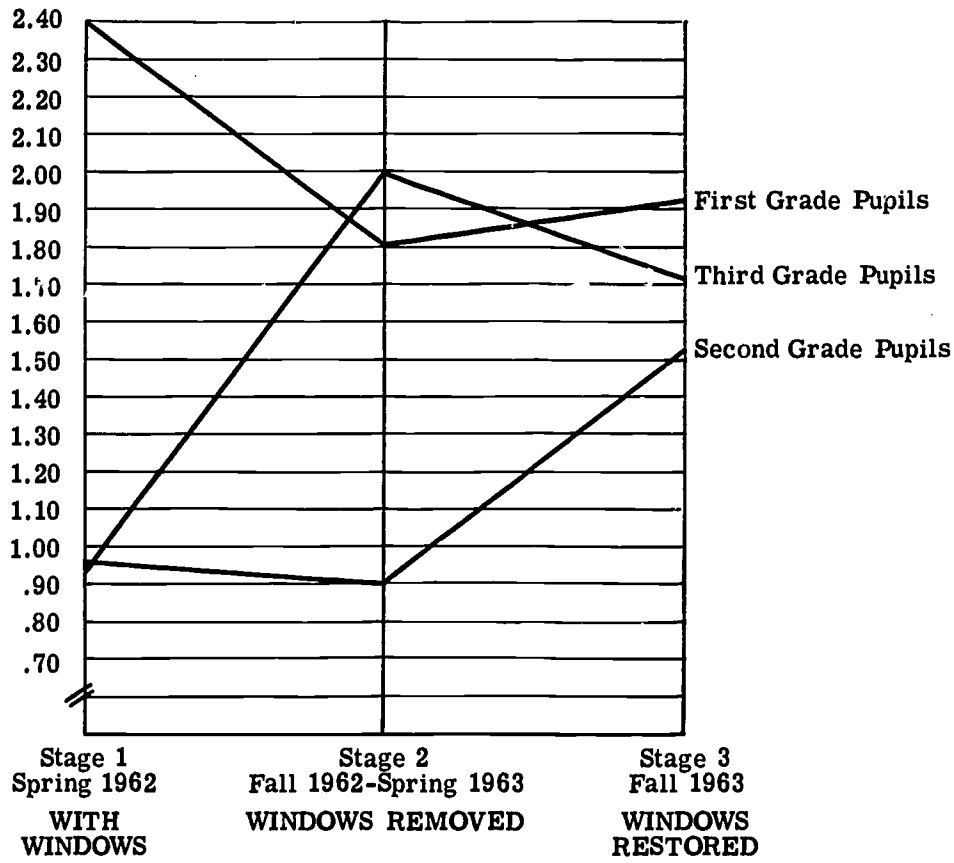
	Boys	Girls	Boys	Girls	Boys	Girls	
High Scores	6 (35%)	10 (71%)	4 (36%)	6 (46%)	12 (75%)	1 (54%)	First Grade
Low Scores	11	4	7	7	4	6	
High Scores	6 (46%)	10 (62%)	1 (8%)	7 (64%)	4 (44%)	9 (82%)	Second Grade
Low Scores		6	11	4	5	2	
High Scores	6 (75%)	13 (82%)	5 (50%)	8 (50%)	2 (17%)	7 (58%)	Third Grade
Low Score	2	3	5	8	10	5	

	Percent with High Grades	Percent with High Grades	Percent with High Grades
Boys	47%	30%	49%
Girls	72%	52%	64%

	Percent with High Grades	Percent with High Grades	Percent with High Grades
All Pupils	61%	42%	56%
	Stage 1 WITH WINDOWS	Stage 2 WINDOWS REMOVED	Stage 3 WINDOWS RESTORED

Figure 5

AVERAGE AMOUNT BY WHICH GRADES FOR INDIVIDUALS VARY FROM THE AVERAGE GRADE FOR EACH CLASS (THE AMOUNT OF VARIENCE OR DEVIANCE IN GRADES FOR EACH CLASS) IN THE HOOVER SCHOOL.



APPENDIX

D

CHANGES IN THE RATES OF PUPIL ABSENTEEISM IN THE HOOVER SCHOOL AT DIFFERENT CASE-STUDY STAGES

analysis by Michael E. Brown

It was assumed that the removal of windows in the Hoover School would affect all classes insofar as the rate of absenteeism is concerned, and that this effect should be most pronounced in those classes less dependent on task material and more dependent on spontaneous environmental factors and activity.

In the following analysis those definitions have been established for the various variables:

(1) *Absence rate:* the number of absences divided by the total number of attendances per group. When all classes are combined, as in Figure 6, the absence rate becomes the total number of absences divided by the total number of attendances per stage.

(2) *Average number of absences per student:* simply the number of absences in a given class, set of classes, or case-study stage, divided by the number of students in the same class, set of classes, or case-study stage.

(3) *Rate of extreme absences:* the number of students in any class, set of classes, or case-study stage, having more than 10 absences, divided by the number of students in the same class, set of classes, or case-study stage.

Table 11 has been prepared as the basis for Figures 6 and 7, Table 12 for Figure 8, Table 13 for Figures 9 and 11, Table 14 for Figure 10, Table 15 for Figure 12, Table 16 for Figure 13, and Table 17 for Figures 14 and 15; these tables and figures all apply to the Hoover School, the test unit. In the case of the Mann School, the control unit, Table 18 serves as the basis for Figures 16 and 17.

As shown by Figures 6 and 11, there is no appreciable difference in the absence rate or in the average number of absences between any two adjacent stages of the case-study in the Hoover School if we consider only the averages for all classes. In passing, it should be noted there is some indication that whereas the average number of absences and the absence rate increased slightly during the course of the three stages, in that same period of time, the control school, Mann, shows a slight decline (see Figures 16 and 17). However, these differences are too slight to be considered evidence of a trend.

It is only when we differentiate between classes, and then between the groups that vary in their task-orientation (kindergarten versus the other grades), that some trends emerge. In contrast to the Mann School where the results do not seem to fit a pattern which is interpretable for the individual classes (see Figure 16), the Hoover School (see Figure 7) shows two rather striking trends, one for the kindergarten classes and one for the other grades. This difference becomes even clearer in Figure 8 where an initial matching of absence rates shifts in two different directions during the windowless stage. No such trend appears in the control school, as shown by Figure 17. Apparently, the second stage in the Hoover School was accompanied by different effects for the task-oriented classes than for the non-task-oriented kindergarten classes. Figure 16 serves to highlight the consistency of this effect.

This observation is reinforced when we look at the average number of absences per pupil (Figures 9 and 10). The trend is evident in the indication in Stage 3 of a change back in the original direction for all groups.

The finding gets additional support when we look at the rate of extreme absences (Figures 12 and 13). Stage 2, the period when the windows were removed, was accompanied by sharp changes in the number of poor absence records per class, with the number decreasing for the task-oriented classes and increasing for the non-task-oriented kindergartens. This leads to the conclusion that where previously the rate of extreme absences between classes was unpredictable, with Stage 2 there now emerges a difference between the two groups which is highly predictable (see Figure 13).

It could be argued that this effect is not a characteristic of the classes, but instead is caused by the presence of individuals in all three stages who are affected by the environmental manipulation in Stage 2 and who in turn account for the observed differences between classes and stages. That this is *not* so is illustrated by Figures 14 and 15: there is no appreciable difference across the three stages, and none that is not explainable by the fact that absences decline in the higher grades, grades through which these students moved during the three case-study stages.

Figure 6

CHANGES IN ABSENCE RATE FOR THREE STAGES, AVERAGE FOR ALL CLASSES IN THE HOOVER SCHOOL.

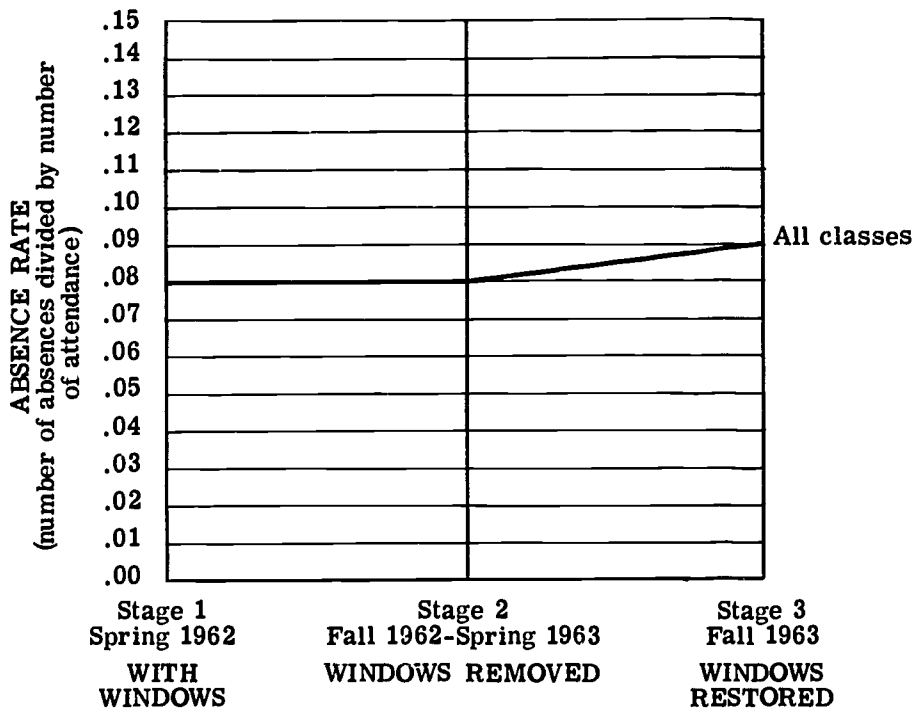


Figure 7

CHANGES IN ABSENCE RATE FOR THREE STAGES, FOR EACH CLASS SEPARATELY, IN THE HOOVER SCHOOL.

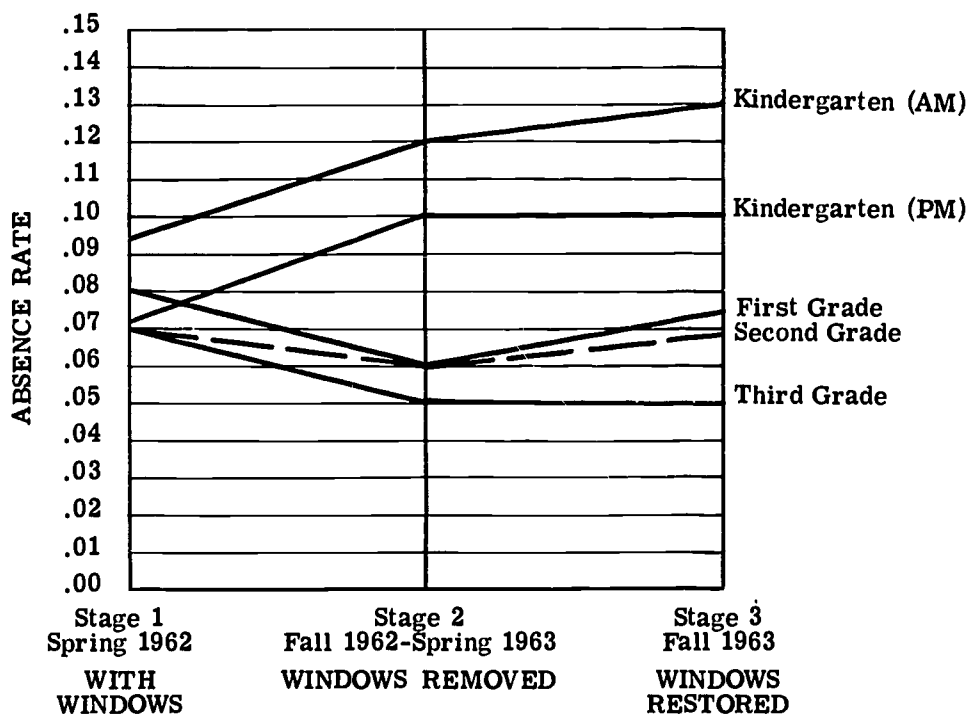


Table 11

CHANGES IN ABSENCE RATE FOR THREE STAGES, FOR EACH CLASS SEPARATELY AND THE AVERAGE RATE FOR ALL CLASSES AS A GROUP, FOR THE HOOVER SCHOOL

Absences	287	569	681	1537	
Attendances	3064	4669	5251	12984	Kindergarten (a. m.)
Ratio	.094	.120	.130	.12	
Absences	207	519	396	1122	
Attendances	2932	4914	3965	11811	Kindergarten (p. m.)
Ratio	.071	.100	.100	.09	
Absences	388	245	385	1018	
Attendances	4940	4075	5204	14219	First Grade
Ratio	.080	.060	.074	.07	
Absences	343	258	223	824	
Attendances	4879	4292	3345	12516	Second Grade
Ratio	.070	.060	.070	.06	
Absences	289	248	214	751	
Attendances	4190	4749	4159	13098	Third Grade
Ratio	.070	.052	.051	.06	
Ratio	.08	.08	.09		All Classes
	Stage 1 WITH WINDOWS	Stabe 2b WINDOWS REMOVED	Stage 3b WINDOWS RESTORED	Totals	

Table 12

CHANGES IN ABSENCE RATE FOR THREE STAGES, COMPARING THE KINDERGARTEN CLASSES AS A GROUP, TO THE OTHER THREE GRADES AS A GROUP, IN THE HOOVER SCHOOL

.082	.110	.117	Kindergarten (both classes)
.074	.057	.065	Other 3 grades
Stage 1 WITH WINDOWS	Stage 2b WINDOWS REMOVED	Stage 3b WINDOWS RESTORED	

Figure 8

CHANGES IN ABSENCE RATE FOR THREE STAGES, COMPARING THE KINDERGARTEN CLASSES AS A GROUP, TO THE OTHER THREE GRADES AS A GROUP, IN THE HOOVER SCHOOL.

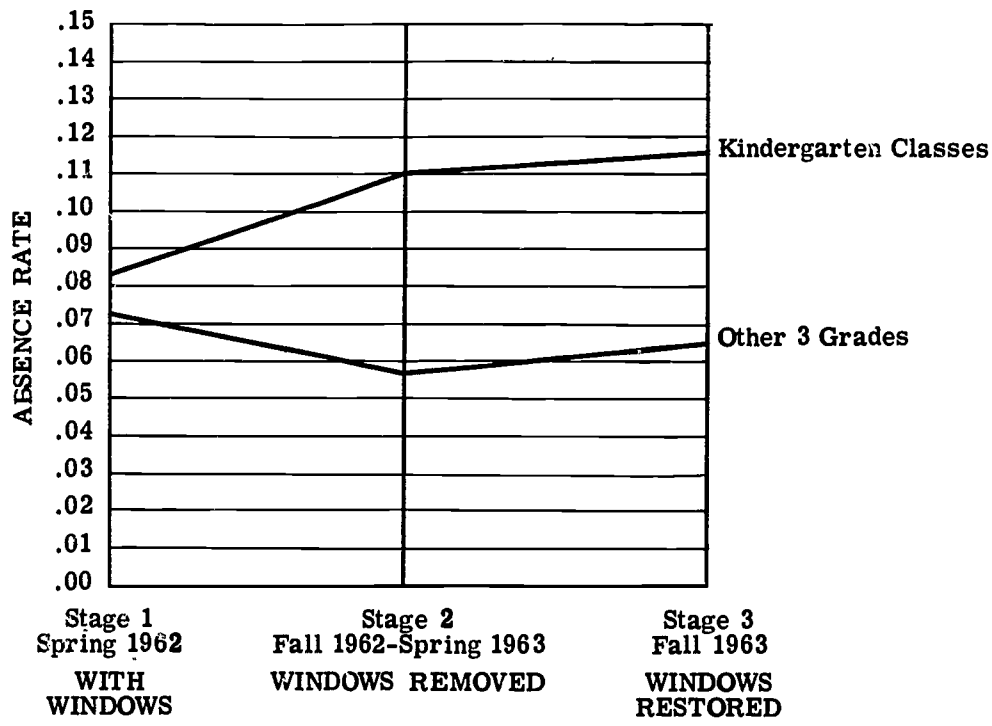


Figure 9

AVERAGE NUMBER OF ABSENCES PER PUPIL FOR THREE STAGES, FOR EACH CLASS SEPARATELY, IN THE HOOVER SCHOOL.

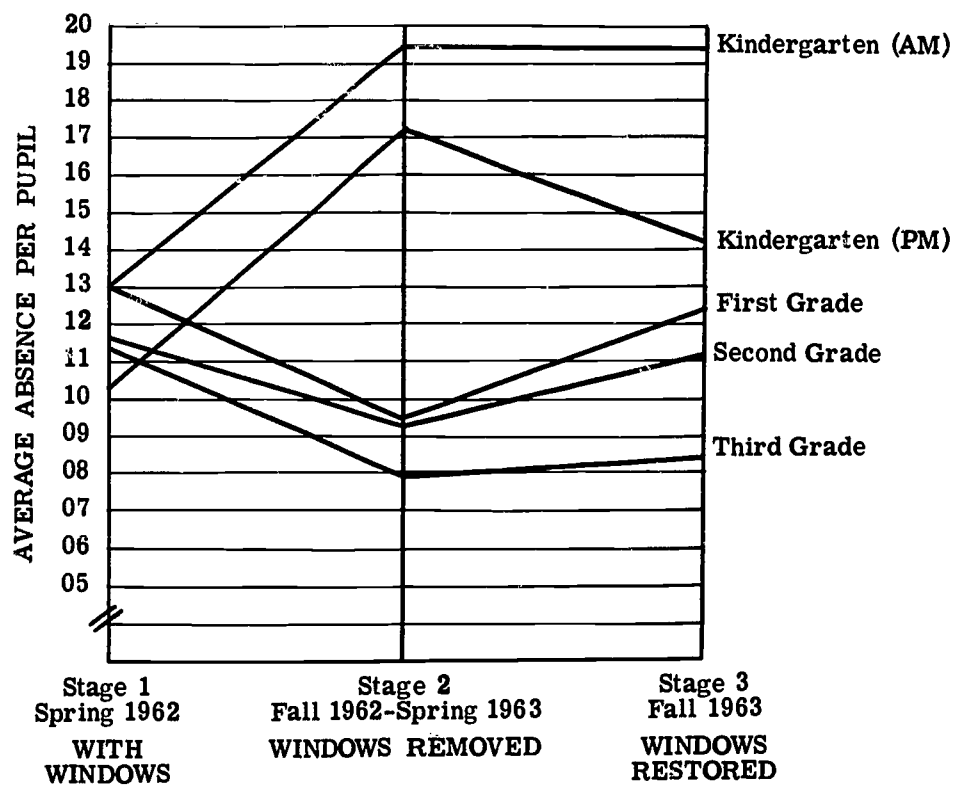


Figure 10

AVERAGE NUMBER OF ABSENCES PER PUPIL FOR THREE STAGES, COMPARING THE KINDERGARTEN CLASSES AS A GROUP TO THE OTHER THREE GRADES AS A GROUP, IN THE HOOVER SCHOOL.

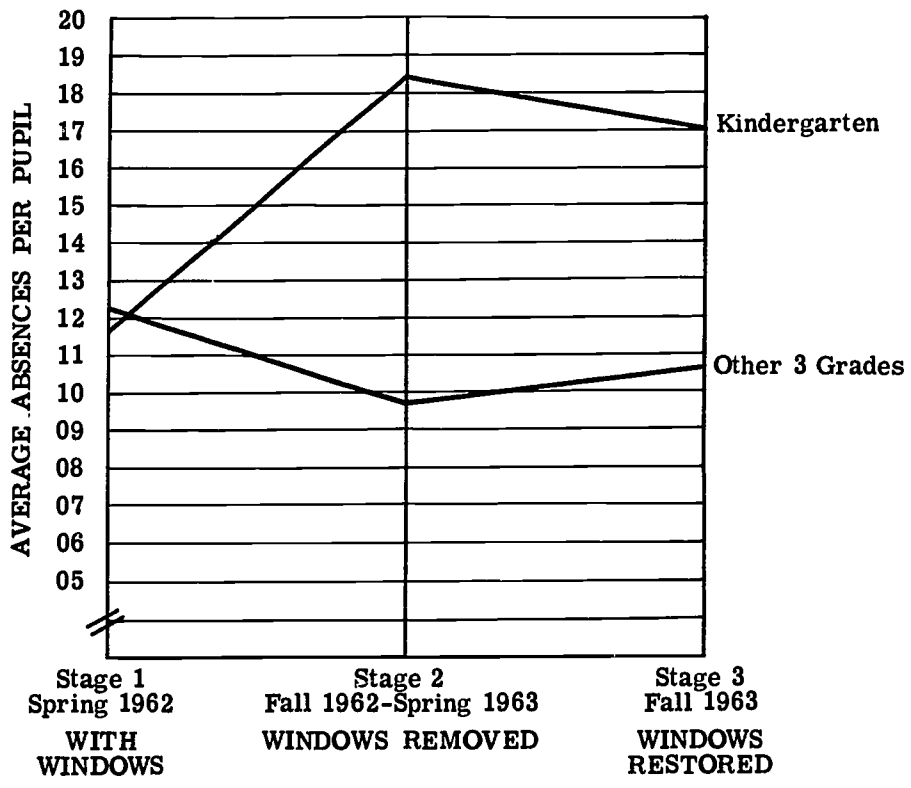


Figure 11

AVERAGE NUMBER OF ABSENCES PER PUPIL FOR THREE STAGES, FOR ALL CLASSES IN THE HOOVER SCHOOL.

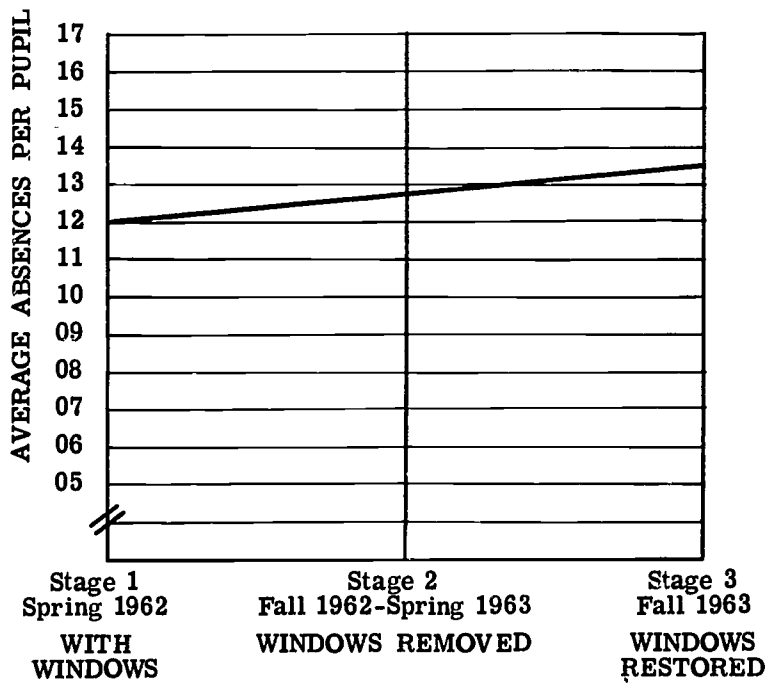


Figure 12

RATIO OF EXTREME ABSENCE RECORDS TO NUMBER OF PUPILS FOR THREE STAGES, FOR EACH CLASS SEPARATELY, IN THE HOOVER SCHOOL.

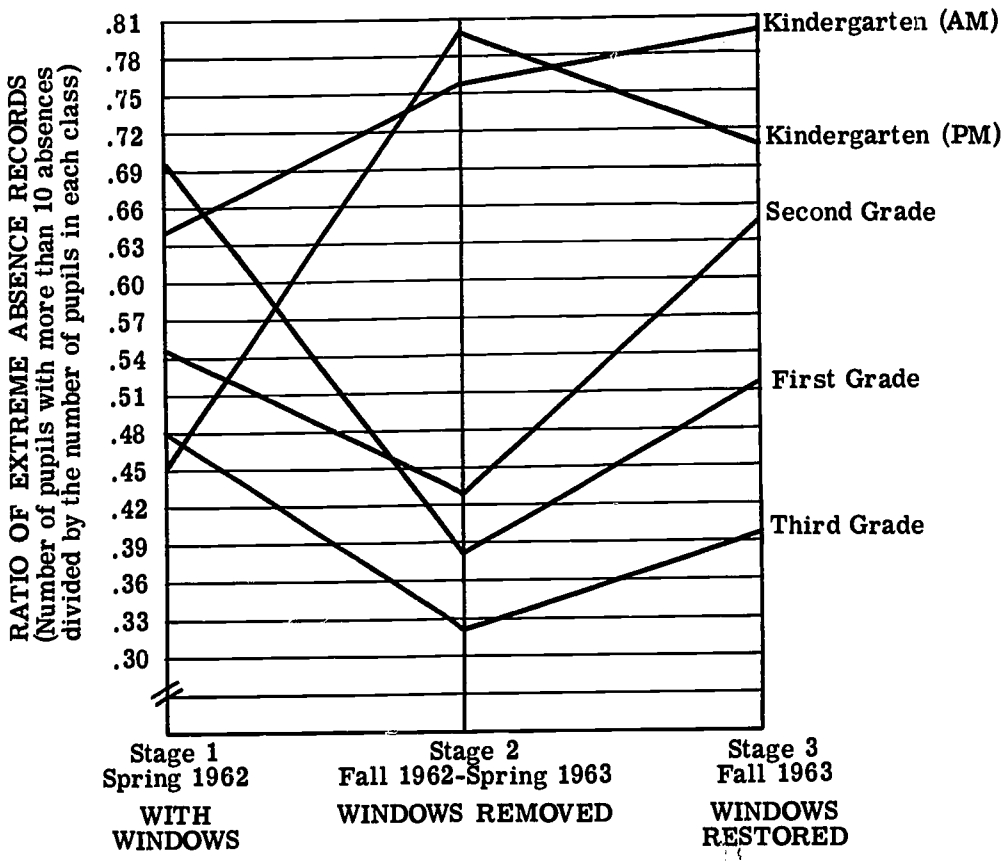


Figure 13

RATIO OF EXTREME ABSENCE RECORDS TO NUMBER OF PUPILS FOR THREE STAGES, FOR KINDERGARTEN CLASSES AS A GROUP AND THE OTHER THREE CLASSES AS A GROUP IN THE HOOVER SCHOOL.

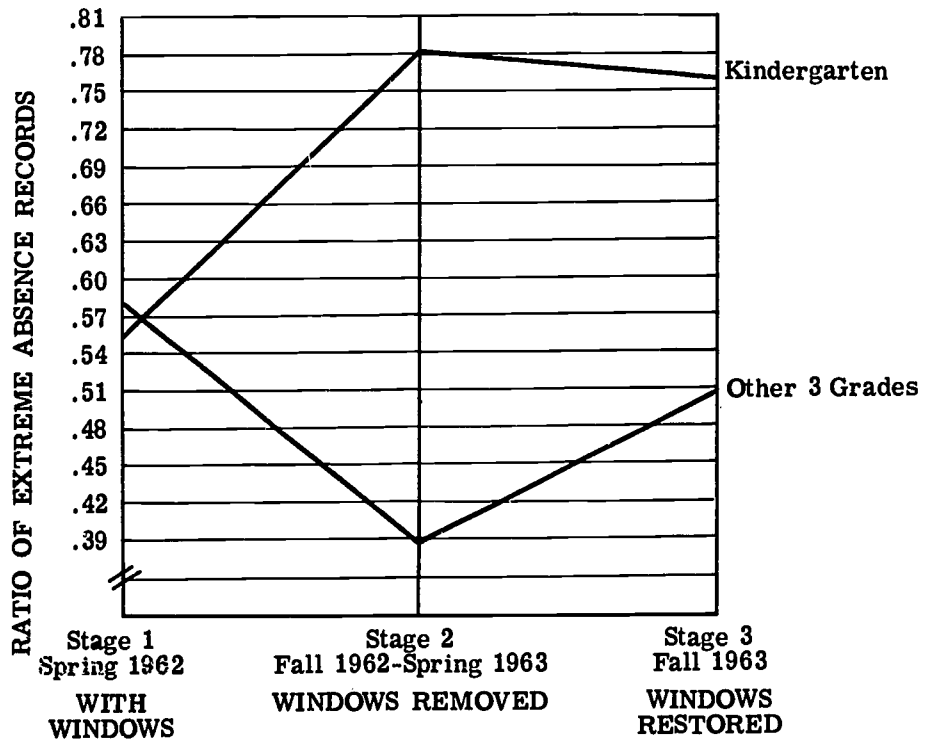


Table 13

AVERAGE NUMBER OF ABSENCES PER STUDENT FOR THREE STAGES, FOR EACH CLASS SEPARATELY, AND FOR ALL CLASSES AS A GROUP, IN THE HOOVER SCHOOL

	Stage 1 WITH WINDOWS	Stage 2b WINDOWS REMOVED	Stage 3b WINDOWS RESTORED	Totals	
Absences	287	569	681	1537	
Enrollment	22	29	35	86	Kindergarten (a. m.)
Average	13.0	19.6	19.5	17.9	
Absences	207	519	396	1122	
Enrollment	20	30	28	78	Kindergarten (p. m.)
Average	10.4	17.3	14.1	14.4	
Absences	388	245	385	1018	
Enrollment	30	26	31	87	First Grade
Average	12.9	9.4	12.4	11.7	
Absences	343	258	223	824	
Enrollment	29	28	20	77	Second Grade
Average	11.8	9.2	11.2	10.7	
Absences	289	248	214	751	
Enrollment	25	31	25	81	Third Grade
Average	11.6	8.0	8.6	9.3	
Average	12.0	12.8	13.7		All Classes

Table 14

AVERAGE NUMBER OF ABSENCES PER STUDENT FOR THREE STAGES, COMPARING THE KINDERGARTEN CLASSES AS A GROUP, TO THE OTHER THREE GRADES AS A GROUP IN THE HOOVER SCHOOL

Stage 1 WITH WINDOWS	Stage 2b WINDOWS REMOVED	Stage 3b WINDOWS RESTORED	
11.8	18.4	17.1	Kindergarten (both classes)
12.1	8.8	10.8	Other 3 Grades

Table 15

RATIO OF EXTREME ABSENCE RECORDS (10 OR MORE ABSENCES) TO NUMBER OF STUDENTS FOR THREE STAGES, FOR EACH CLASS SEPARATELY, IN THE HOOVER SCHOOL

10 + Absences	14	22	28	64	Kindergarten (a.m.)
Enrollment	22	29	35	86	
Ratio	.64	.76	.80	.74	
10 + Absences	9	24	20	53	Kindergarten (p.m.)
Enrollment	20	30	28	78	
Ratio	.45	.80	.71	.68	
10 + Absences	21	10	16	47	First Grade
Enrollment	30	26	31	87	
Ratio	.70	.38	.52	.54	
10 + Absences	16	12	13	41	Second Grade
	29	28	20	77	
	.55	.43	.65	.53	
10 + Absences	12	10	10	32	Third Grade
Enrollment	25	31	25	81	
Ratio	.48	.32	.40	.40	
Ratio	.57	.54	.62		All Classes
	Stage 1 WITH WINDOWS	Stage 2b WINDOWS REMOVED	Stage 3b WINDOWS RESTORED		

Table 16

RATIO OF EXTREME ABSENCE RECORDS (10 OR MORE ABSENCES) TO NUMBER OF STUDENTS FOR THREE STAGES, FOR THE KINDERGARTEN CLASSES AS A GROUP AND THE OTHER THREE CLASSES AS A GROUP, IN THE HOOVER SCHOOL

.55	.78	.76	Kindergarten (both classes)
.58	.38	.51	Other 3 Grades
Stage 1 WITH WINDOWS	Stage 2b WINDOWS REMOVED	Stage 3b WINDOWS RESTORED	

Figure 14

CHANGES IN ABSENCE RATE FOR THREE STAGES AMONG PUPILS WHO WERE INVOLVED IN ALL THREE STAGES IN THE HOOVER SCHOOL.

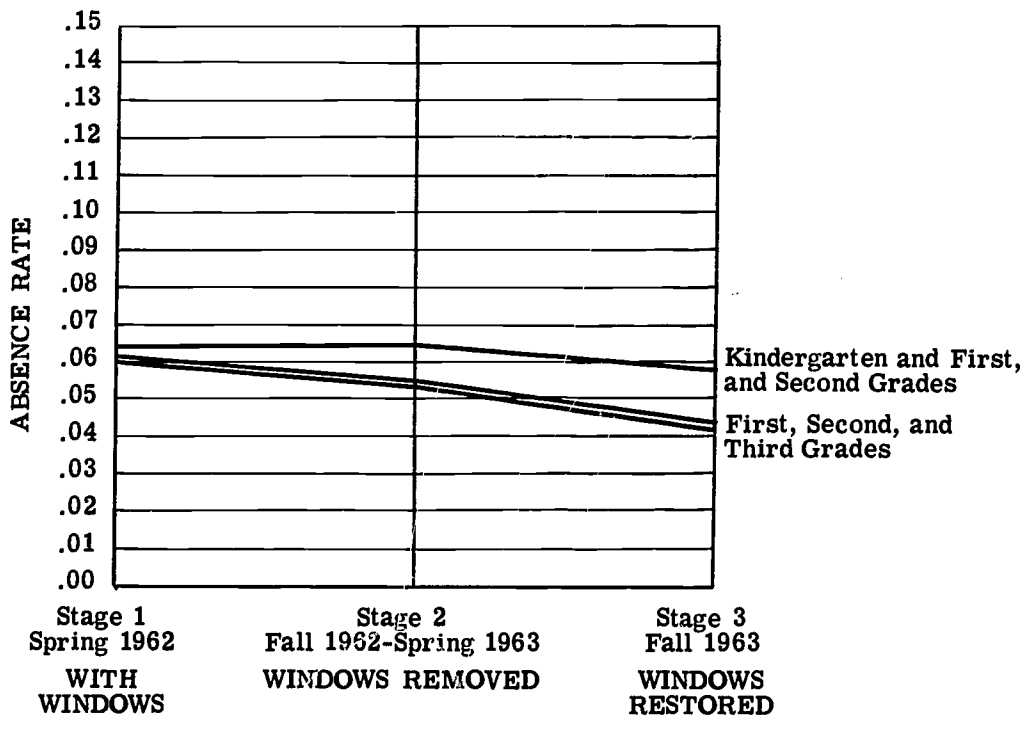


Figure 15

AVERAGE NUMBER OF ABSENCES PER PUPIL FOR THREE STAGES, FOR THOSE PUPILS WHO WERE INVOLVED IN ALL THREE STAGES IN THE IN THE HOOVER SCHOOL.

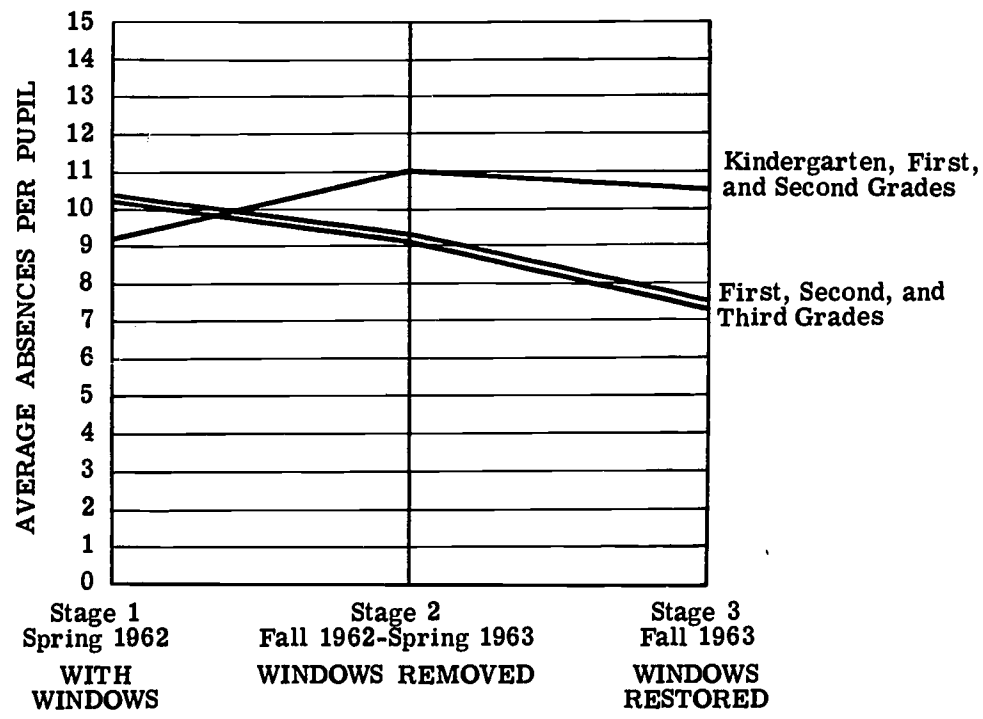


Table 17

CHANGES IN ABSENCE RATE AND AVERAGE NUMBER OF ABSENCES PER PUPIL, FOR THE PUPILS WHO WERE INVOLVED IN ALL THREE STAGES IN THE HOOVER SCHOOL

	Stage 1 WITH WINDOWS	Stage 2 WINDOWS REMOVED	Stage 3 WINDOWS RESTORED	
Attendances	2060	2237	2270	Kindergarten and First and Second Grades
Absences	129	142	135	
Ratio	.063	.063	.059	
Enrollment	13	13	13	
Average	9.2	10.9	10.4	
Attendances	3043	3122	3140	First, Second and Third Grades
Absences	186	170	134	
Ratio	.061	.054	.042	
Enrollment	18	18	18	
Average	10.3	9.3	7.4	
Ratio	.062	.058	.031	All Classes
Average	10.2	10.1	5.5	

Figure 16

CHANGES IN ABSENCE RATE FOR THREE CONTROL STAGES, FOR EACH CLASS SEPARATELY, IN THE MANN SCHOOL.

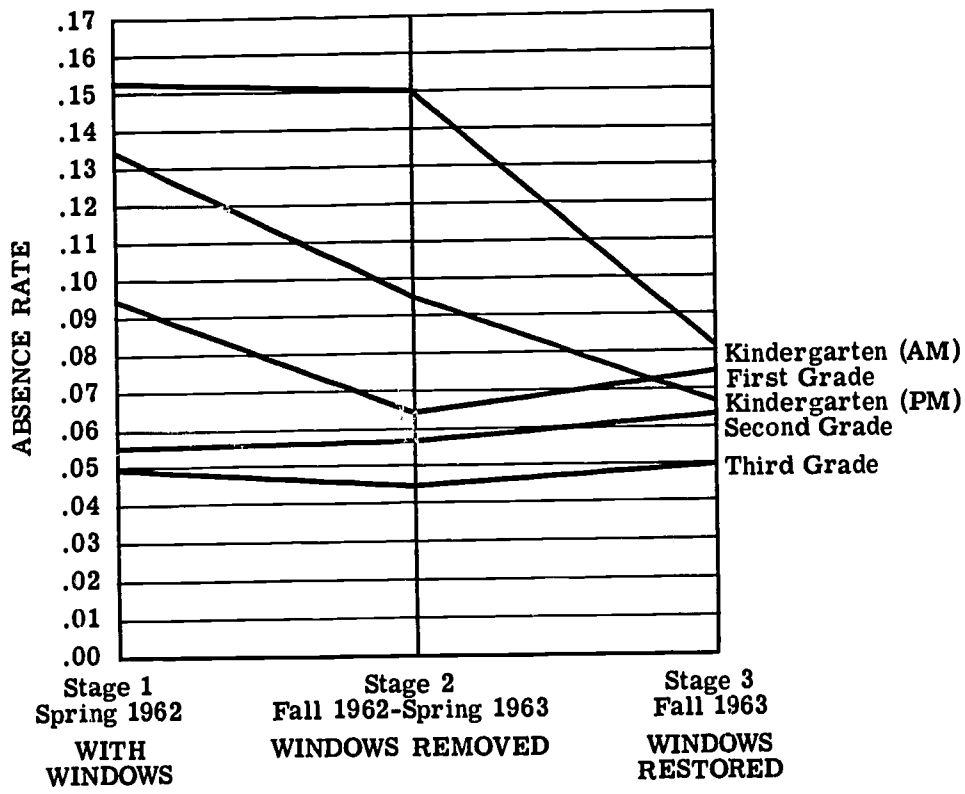


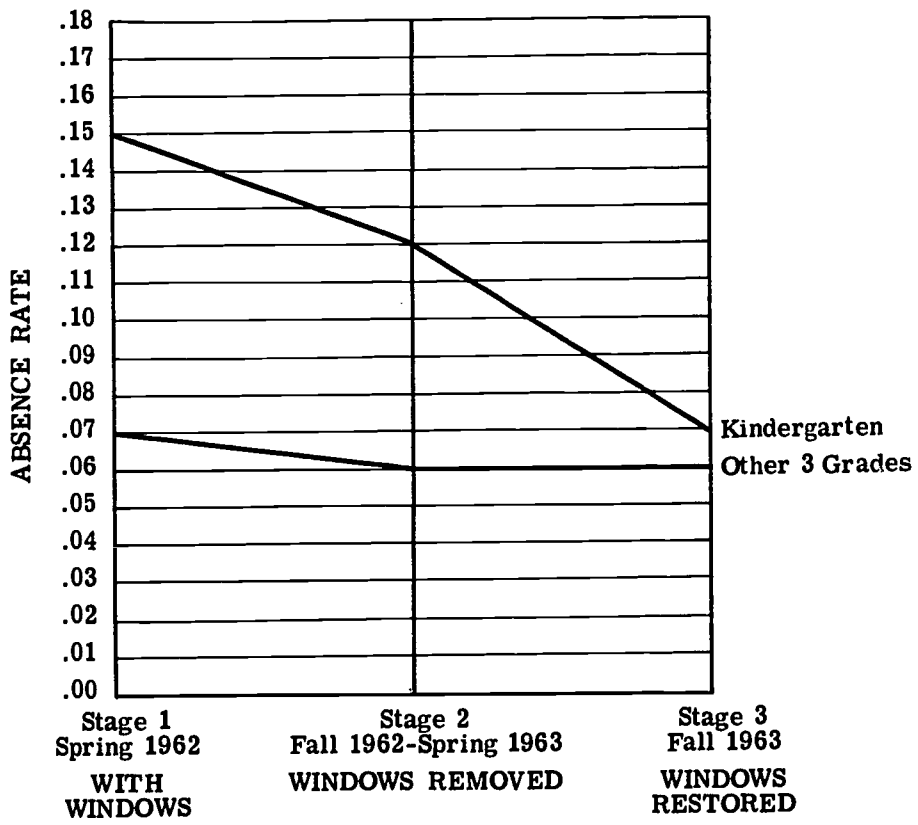
Table 18

CHANGES IN ABSENCE RATE FOR THREE CONTROL STAGES, FOR EACH CLASS SEPARATELY, AND COMPARING KINDERGARTEN CLASSES AS A GROUP TO OTHER CLASSES AS A GROUP, IN THE MANN SCHOOL

	Stage 1 WITH WINDOWS	Stage 2 WINDOWS REMOVED	Stage 3 WINDOWS RESTORED	
Absences	613	562	308	
Attendances	4017	3744	3824	Kindergarten (a.m.)
Ratio	.153	.150	.081	
Enrollment	27	28	25	
Absences	353	310	243	
Attendances	2604	3328	3580	Kindergarten (p.m.)
Ratio	.135	.093	.068	
Enrollment	20	25	24	
Absences	483	322	404	
Attendances	5054	5087	5317	First Grade
Ratio	.096	.063	.076	
Enrollment	30	33	33	
Absences	238	265	260	
Attendances	4387	4643	4013	Second Grade
Ratio	.054	.057	.065	
Enrollment	25	27	32	
Absences	232	222	229	
Attendances	4601	4777	4689	Third Grade
Ratio	.050	.046	.049	
Enrollment	28	29	28	
K's as a Group	.145	.123	.074	Kindergarten (Both Classes)
1, 2, 3 as a Group	.068	.056	.064	Other 3 Grades

Figure 17

CHANGES IN ABSENCE RATE FOR THREE STAGES, COMPARING THE KINDERGARTEN CLASSES AS A GROUP, TO THE OTHER THREE GRADES AS A GROUP, IN THE MANN SCHOOL.



PUBLICATION

Cover and format by Robert M. Beckley, Assistant Professor of Architecture, assisted by Mary Ashley.