

THE EFFECTS OF THE ENVIRONMENT ON THE
LEARNING AND BEHAVIORAL TENDENCIES OF THE SECONDARY STUDENT
IN THE OPEN SPACE CONCEPT SCHOOL

by 4589

DOROTHY LUCILE MONTY

B. S., Marymount College, 1938

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1970

Approved by:


Major Professor

LD
2668
R4
1970
M65
C.2

TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
Chapter	
1. INTRODUCTION	1
THE PROBLEM	2
Statement of the problem	2
Limitations and delimitations	2
Definitions of Terms Used	3
Open space concept school	3
Environmental factors	4
2. REVIEW OF THE LITERATURE	5
Literature on Environmental Factors	5
Temperature	5
Lighting	7
Color	8
Sound	9
Furniture and equipment	14
Space	15
A Comparison of Three Secondary Schools	18
Effectiveness of Teachers and Counselors	26
3. THE OPINIONAIRE	30
4. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	37

Chapter	Page
BIBLIOGRAPHY	39
APPENDIX A. Opinionaire	41
Figure 1	42

LIST OF TABLES

Table	Page
1. The Percentage of the Opinions of Parents Favoring or Disfavoring Ten Proposals on Teaching Innovations	31
2. The Percentage of the Opinions of Teachers-Administrators Favoring or Disfavoring Ten Proposals on Teaching Innovations	33
3. The Percentage of the Opinions of Parents and Teachers-Administrators Favoring Ten Proposals on Teaching Innovations	34

CHAPTER I

INTRODUCTION

The enrollment at Salina High School has long exceeded the maximum capacity for which the building was erected. The administration has for several years recognized the need for additional classroom space long before a new high school became a reality. Several years ago plans were made to construct a dressing room facility to complement the high school stadium. A logical solution to the urgent need for classroom space seemed to be the construction of the dressing room facility and fitting it as a temporary classroom complex.¹

Since the Salina school administrators and school board recognized the acute problem of needed facilities, they presented the problem to the citizens of Salina Unified District #305 who approved the additional secondary structure. Initial planning for the construction of a new secondary building took into consideration the need for an innovative building to house a progressive curriculum. In cooperation with school personnel, the architect designed a building that permitted change in teaching techniques during the life of the building.

The age of space is upon us and if secondary education doesn't take on "the new look," it may find itself preparing citizens for yesterday rather than today and the fast developments of the future.²

¹The Salina Public School Unified School District 305, "New High School Facility," Staff Bulletin, (November, 1968), p. 4.

²Paul E. Coble, "Looking Ahead in Secondary Education," Peabody Journal of Education, XLVI (September, 1968), p. 90.

Revolution has erupted in the nation's schools, but it is not the kind of revolution caused by student activists, dissident teachers, or desegregation orders. The revolution is in the ranks of school architects and is the result of studies, evaluations, and architects' ideas of the perfect educational environment.

Gone are the chairs set in neat rows in four-walled classrooms. Gone are the windows. And gone are the walls. Open space schools are the new look, and Salina will have its own example of the new trend in school buildings when Salina High School--South opens its doors in the fall.³

I. THE PROBLEM

Statement of the problem. This project was initiated to study selected factors related to the control of the physical environment in the open space secondary school and to investigate by an opinionaire whether parents, teachers, and administrators felt that open space classrooms facilitated innovative teaching.

Limitations and delimitations. The survey was limited by the factors below:

1. Environmental factors included were:
 - a. temperature
 - b. lighting
 - c. color
 - d. sound
 - e. furniture and equipment

³Barbara Phillips, "Architects Join Classroom Revolt," Salina Journal, April 19, 1970, p. 36.

f. space

2. Application was limited to the three open space schools that were compared.

3. The role of teachers and counselors was limited to their effectiveness in such an environment.

4. An opinionaire on innovative teaching practices was limited to a random sample of twenty teachers-administrators now teaching in the Salina Senior High School and twenty parents of students now enrolled in the home economics program at Salina Senior High School. The students surveyed will be enrolled in Salina's open space high school in the fall, 1970.

5. Since the open space concept has been a fairly recent innovation, the review of literature had to be limited to recent magazine and newspaper articles, interviews, school brochures, reports, and profiles.

II. DEFINITIONS OF TERMS USED

Open space concept school. This is a building structure where classrooms are constructed in various sizes. Most rooms are large enough to seat seventy-five students easily; however, space adapted to small groups and independent study can be obtained by the use of moveable wall dividers and study carrels. Large commons areas containing circular tables can be used for small groups, for testing or for instructing up to 150 students.

This type school is usually divided into two parts: one part contains rooms used for academic activities and administration, while the other part contains physical education, music, drama, home economics, and vocational shops.

Environmental factors. Factors which become involved with physical facilities of the open space building are those variables which contribute to opportunities for learning and behavior modification. These are:

- a. temperature
- b. lighting
- c. color
- d. sound
- e. furniture and equipment
- f. space

CHAPTER II

REVIEW OF THE LITERATURE

Educators and architects have joined forces to provide the proper climate for optimum learning. Gone is the day when the self-contained classroom is the ultimate in education. Some of the nation's most gifted architects have devoted themselves to school architecture in these past ten years, looking at many aspects of school life, including the environment which encourages greater interaction between pupils and teachers. The literature reviewed included the environmental factors which the writer found to be the most important.

I. TEMPERATURE

If a room is either too hot or too cold for teacher and students, the discomfort may seriously block the educational process. The open space school has a central heating and cooling system that is simplified by fewer walls, thereby reducing the number of thermal zones and requiring fewer thermostats. Windows can be like magnifying glasses, taking the rays of the sun and increasing the magnitude of their effect in the classroom. Very few windows are used in the building, reducing the problems associated with solar heat gain. The modern thermostat control system permits a year-round controlled temperature of 68 to 75 degrees.⁴ This enables

⁴A Profile of a Significant School, Clarksville High School, Clarksville, Tenn., 1968.

students and teachers to work comfortably and avoid the fatigue caused by an uncontrolled thermal environment.⁵

Today, unit ventilators are finding an essential place in windowless schools, in circular schools, in cluster schools, in flexible schools--in just about every variation on the educational-building theme that has been tried. What makes this reassuring in a proverbially changing world is that unit ventilators have always provided a simple, economical means for the two-way temperature control so essential to schoolrooms. By this is meant simultaneous heating and cooling capacity to meet the needs of each separate educational space--where thermal requirements vary with occupancy (school children are little stoves!); with the use or non-use of high level lighting (as with audio-visual equipment); with sunshine or the lack of it (since mighty Old Sol manages to make his warmth felt through walls and roofs, even in windowless schools). This type ventilation prevents overheating without the stratification of drafts associated with window ventilation. Because of the proper ventilation in the clustered open-space classroom, many students no longer sleep through lectures because of poor ventilation.⁶

In terms of more learning for the students, better teaching by the staff and higher morale for all, it may be that the return is substantial. When air circulation is poor, air exchange inadequate, heat or cold in an

⁵A Profile of a Significant School, New Providence Junior High School, Clarksville, Tennessee.

⁶Herman Nelson, "Architects Are Ingenious People," A Report by American Air Filter Co., Inc., School Products Dept., p. 4.

extreme, mental and physical efficiencies are impaired. Where properly balanced thermal systems have been installed, there is increased efficiency and morale and better personal health.⁷

II. LIGHTING

Indirect lighting is recommended for use in all instructional spaces. Indirect lighting reduces glare and results in greater visual comfort. A serious lighting difficulty in older school buildings is caused by the competition of natural light with artificial light. This problem is eliminated by reducing the number of windows.⁸

In September 1961 the attention of school architects and school administrators throughout the United States was drawn to the problem of the windowless classrooms. The whole concept of fenestration had come into questioning as the result of advances in air conditioning and artificial illumination. 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 produce problems of heat transmission and visual glare. In the windowless classroom there is no direct sunlight, no glare, no distraction, such as weather, or outside noises. There is more wall space for display purposes.⁹

⁷Frank Carioti, Design for ETV (prepared by Dave Chapman, Inc., Industrial Design for Educational Facilities Laboratories, 1960), revised 1968.

⁸A Profile of a Significant School, New Providence Junior High, loc. cit.

⁹Architectural Research Laboratory, Dept. of Agriculture, U. of Mich., The Effect of Windowless Classrooms on Elementary School Children, Nov. 1965, p. 17.

Proper lighting must be tailored to the specific need in each space. Obviously it is important to have lighting of proper intensities for different tasks, or else the student will unconsciously divert a good deal of his energy to the task of seeing, with less left for the job of learning. Appropriate lighting should be planned for each area in which varying tasks may be pursued. Moveable fixtures and lamps as well as switching or dimmer installations can allow great functional variety. Chalkboards should ordinarily be lighted so students can see materials without glare or insufficient illumination.¹⁰

III. COLOR

Closely related to lighting is the factor of color. Colors ideally are selected on the basis of reflection of light and psychological effect. Care must be taken to insure that high contrast between walls, floors, furniture, and instructional materials does not occur.¹¹

Color becomes essential in the open schools to relieve the monotony of space. Soft yellow and other warm colors are used in academic areas to stimulate creativity. In areas where students are very active, such as, commons or study areas, soothing colors which are subtly relaxing are used. Yellows and reds are motivational colors, while blues and greens are more soothing. Ceilings usually are white for reflecting purposes. The white also makes the space seem larger.¹²

¹⁰Carioti, loc. cit.

¹¹A Profile of a Significant School, Clarksville High School, loc. cit.

¹²Phillips, loc. cit.

If room colors are depressingly drab, the atmosphere discourages enthusiasm. Color in the schools is not restricted to walls and woodwork that are given a flat coat of paint. There is color in the structural materials that are left exposed in school areas--brick, stone, natural wood, brushed metal frames. There is color in the cork of the tackboard, in the brightly colored sketches in the display areas, in the wall maps and the lighted aquarium. There is color in the chairs and desks and all of these should be considered along with the fact that the students themselves provide a constantly changing spectrum of color. In many ways the trend in color and design of interior spaces of the high school is to become more sophisticated --to reflect the amenities of the adult world. Responses of the student in his middle teens are more subtle--and in many ways more sensitive than those of his juniors. Using color in high school will demand more skill and imagination on the part of those who set the dyes.¹³ Carpet provides a tremendous choice of colors, textures, and designs, making rooms more serene and pleasant. Psychologically, carpeting lends a feeling of warmth to the interior.¹⁴

IV. SOUND

Uncontrolled sounds within a school may bring about distraction and irritation. Uncontrolled sound is kept to an absolute minimum via wall-to-wall carpeting, acoustical plaster, roof design, and other sound dampening equipment.¹⁵

¹³Carioti, loc. cit.

¹⁴American Carpet Institute, Inc., New York, N.Y., Sound Conditioning with Carpet.

¹⁵A Profile of a Significant School, Clarksville High School, loc. cit.

The open space concept theater, for example, may be chosen because it has no proscenium arch, an artificial barrier which separates the performers from their audience. This permits one sound chamber for the entire theater. Carpeting, if used in over 80% of the school, prevents sound production at its source, the floor. In addition, a pyramid-shaped roof covered with acoustical plaster will trap sound and prevent it from becoming uncontrollable. A major and chronic producer of noise in the conventional school is the metal locker. Located away from the normal traffic flow, the lockers should be of wood construction and open and close quietly.¹⁶

There is a trend in the recently constructed school buildings in the United States to design interior spaces which are more open. In the search for relationships in space and function between rooms, which arise from newer teaching methods, partitions are not as frequently employed as they used to be to isolate one space from another. One of the problems presented by this trend is the design and treatment of the acoustical environment.¹⁷

One of the criteria which has been generally accepted and used has been that an acoustical separation of forty decibels or sound levels between adjoining teaching spaces is desirable. The acceptance of this criterion makes it difficult to relate two adjoining teaching areas by opening them widely into each other, or by separating them with folding partitions. The trend of school building planning, therefore, is a search for spaces that will house a great variety of activities under conditions that make

¹⁶A Profile of a Significant School, New Providence Junior High, loc. cit.

¹⁷Daniel Fitzroy and John Lyon Reid, Acoustical Environment of School Buildings, Technical Report from Educational Facilities Laboratories.

all kinds of intercommunication as direct as possible; this leads to a growing openness of plan. It is understandable that the acoustical environment of the newer schools is a problem for the architect and for the acoustical engineer.¹⁸

It is necessary to determine the minimum acoustical separation that is necessary to allow a group or an individual to work effectively. In how noisy an environment can a teacher and a group of students work, communicate, and study without extraneous, unwanted sounds interfering? What kinds of sounds are objectionable, and what is the limit of tolerable sound levels? We recognize that special rooms for music, assembly, dining, and other activities require different criteria. We believe that the acoustics of the learning environment have, in the past, been given much less attention than they deserve.¹⁹

As more sound sources combine, as in open classrooms where speech sounds from many classrooms may be added together, the intruding speech sounds blend together into a somewhat bland hum without easily identifiable speech components. This seems to be the reason why open classrooms have been found to be acceptable in such high percentages. When the room is near speech optimum, both speech and listening are comfortable. Even audio-visual instruction can be made more acceptable by careful attention to the sound level.²⁰

¹⁸Ibid., p. 8.

¹⁹Ibid., p. 9.

²⁰Ibid., p. 19.

Authorities on teaching have known for years that carpeting could contribute immeasurably to the environment of education. Every attempt should be made to eliminate disruptive noise at the source. Hard surfaces are not only sound reflective but are the origin of most disturbing sounds in a classroom. A soft floor covering will muffle or eliminate disruptive sounds of dropping pencils and books, clicking heels or footsteps, and scraping furniture. The psychological effects of carpeting in the classroom also go a long way toward establishing natural disciplinary controls over both the sound output of the student and his general behavior. Experience also indicated that carpeting is also economically feasible in school installations.²¹

It is believed that carpeting contributes significantly to the "deinstitutionalizing" of the school and school life. Students take greater pride in the school and are more relaxed in the activities they carry on there. And this pride extends to school properties, too. Such problems as defacing of desks, walls, and other surfaces are practically non-existent. The presence of carpet has been observed by the faculty as a major cause of positive habit development by students using these areas. Boys wearing hats as they enter the building immediately remove them upon feeling the carpet under foot. Loud talking and horseplay in the corridor has been seen to cease when the group reaches the carpeted area.²²

²¹American Carpet Institute, New York, N.Y., Excellence and Economy, p. 10.

²²Ibid., p. 13.

There is a unanimous feeling on the part of school staffs that they would prefer to teach in carpeted rooms. Because the atmosphere is informal, teachers find it easier to develop a closer relationship between student and teacher. When they speak of quiet, they are not speaking of the acoustic absorption quality of carpet. They are speaking of the complete elimination of obnoxious sounds in the carpet area. The level of the speaking voice in the carpeted areas is consistently lower than it is in the uncarpeted areas. Pencils and pens are noiseless when they are dropped to the floor. In fact, pencils are not dropped to the floor for this reason. Constant sounds, such as ventilator fans and other equipment that create constant noise levels which must be overcome by the teacher's voice, are reduced in the carpeted areas. Thus, the teacher can use a normal speaking voice and his normal voice level encourages normal responses from the students. Teachers and students are less fatigued after a day on carpeted floors.²³

Acoustical engineers have found that a classroom ceiling should not be a sound absorber; a hard, reflective ceiling is a valuable aid in transmitting a speaker's voice to the back of the room. The hard surface reflects the sound energy down to the seats in the back rows. An acoustically treated ceiling would absorb this energy. Carpeting absorbs much of the noise before it can become noise. Thus, with carpet, the room has an acoustical floor: moving chairs or shuffling feet are noiseless activities in a carpeted room. Carpet can reduce classroom noise by as much as 50%.²⁴

²³Ibid., p. 14.

²⁴Ibid., p. 21.

Schools with an open plan require a high degree of acoustical absorption which is furnished by the carpeting. However, the most important reason for the use of the carpeting is the dignified environment which results from such an installation. Behavior patterns were enormously improved in the kind of environment in which carpeting is an important part. When schools are built with few partitions, the acoustics emerge as an important aspect of secondary school design.²⁵

The school of today can benefit from the inherent quiet of a carpeted floor--a psychological aid to teaching and learning which simply cannot be achieved with any other material, regardless of its cost.²⁶

V. FURNITURE AND EQUIPMENT

Office and classroom equipment must be considered in initial planning. Furniture should be selected on the basis of flexibility, mobility, attractiveness, safety, durability, comfort, and ease of maintenance.²⁷

Flexibility and adaptability determine equipment selection unique to offices, classrooms, commons areas, and library and should be chosen with matching and contrasting colors receiving due attention.²⁸

Classrooms served by a corridor may be screened from the corridor by a partition of storage units which are open at the top and bottom; thus there are no sound intercepting elements between the classrooms and corridor.²⁹

²⁵Ibid., pp. 32-33.

²⁶Ibid., p. 34.

²⁷A Profile of a Significant School, Clarksville High School, loc. cit.

²⁸A Profile of a Significant School, New Providence Junior High School, loc. cit.

²⁹Fitzroy and Reid, op. cit., p. 99.

Facilities can make or break the effectiveness of both the teacher and the learning program. The teacher's center in the future school will be more than just a desk and chair. It will be a work center for the teacher, with reference material, files, and supplies close at hand. It will serve as a suitable area for counseling and possibly for small group activity which the teacher can lead. It will be a control center for electronic equipment in the learning area--lighting, partitioning devices, intercom, and public address system. It will be so designed as to be both efficient and attractive--a place where the teacher will want to work and the student will want to visit. The individual study unit may be trapezoid shaped, groupable in various combinations, drop leaf for larger work top, and may also be used as a divider. Storage spaces may have perforated board or corkboard for bulletin board, teaching surfaces, or storage. Chairs may have disappearing writing surfaces or rotating surfaces for convenience.³⁰

Food service could be provided from rolling hot carts or from service areas set off from one of the main rooms behind an acoustical partitioning wall to prevent intrusion of kitchen sounds in the adjoining study area.³¹

VI. SPACE

The building structure makes team teaching more effective. Classrooms are constructed in various sizes. Most rooms are large enough to easily seat seventy-five students to introduce units, to give tests, and to present films, lectures, and demonstrations. However, small groups for laboratory

³⁰Carioti, loc. cit.

³¹Ibid.

work, research, and discussion and independent study for individual research can be attained by using moveable wall dividers. Large common areas containing circular tables may be used for small groups or for the instruction of up to 150 students. This makes for effective team teaching and multiple grouping. In addition, an auditorium or "Little Theater" of approximately 350 seats should be available for special group arrangements. This area may also be used by teachers for in-service meetings and by community groups for discussion sessions. A compact building may contain as many square feet as a rectangular building but corridor space is drastically reduced, allowing for a more economical and efficient use of space. To provide the best environment for effective education, a central open concept library and approximately six instructional materials centers should be included.³²

The new school of today is designed for a highly flexible program which calls for considerable interdependence among the teachers. While the old school's size and design prohibited communications, the new school facilitates it. Gone are the cement walls, the chairs set in neat rows, the privacy of the classroom, and the autonomy of activity. To counteract some of these changes, it is necessary for the teachers to develop a cooperative, cohesive group which will enable them to work out foreseeable problems. The open planning and the highly flexible classroom make it virtually impossible for some of the teachers to transfer directly all of their experienced procedures to the setting of a new school. It is necessary to modify their style of

³²A Profile of a Significant School, New Providence Junior High School, loc. cit.

teaching or face the frustration of trying to teach in a way for which the building was not designed. Slowly they begin to experiment with less-structured total school program and find that the classes are productive and easy to manage. Students like the relaxed atmosphere and with these success experiences, teachers begin to feel more secure.³³

The open space building is not prisonlike. It doesn't subject students to the influence of any one person for too long. It gives them the protection and interaction of many adults. It exposes them to a variety of personalities and activities and experiences. It permits them to move and gives them places to go. The whole atmosphere is more relaxed.³⁴

All are well aware of the fact that a pleasant, comfortable environment generally promotes a higher level of learning. The way we live and learn is affected by the kind of school structure we have created. Our school buildings should be designed to provide an environment which enhances the learning process. School buildings, therefore, should be designed to fit the school district's specific educational program. Flexibility should be built into the design to permit modification of the structure as the curriculum and the population adjust to change. The educational specifications become a written translation of the curriculum into required spaces for learning, including the necessary physical facilities.

The greatest expectations for the future generations of the community should be reflected in the educational planning of school buildings. The

³³Architectural Research Laboratory, op. cit., pp. 21-22.

³⁴Educational Facilities Laboratories, New York, N.Y., Profiles of Significant Schools--Schools without Walls, April 1968, p. 54.

planning should be based upon a sound working philosophy of education which is stated in the educational policy of the school district. Competent school officials should be capable of translating the philosophy, teaching methods, functions, and space requirements of the educational program into the educational specifications for the proposed project a new building and un-indoctrinated teachers are a bad combination.³⁵

VII. A COMPARISON OF THREE SECONDARY SCHOOLS

Much has been said about building schools for the future. In one respect, this continuing dialogue is symptomatic of man's deep-seated wish to influence the minds of his descendants. In another, it is evidence of his growing conviction that coming generations must be uniquely equipped to cope with a technology we have only begun to understand. "Education," states the introduction to one set of educational specifications, "must prepare the minds of students for work that does not yet exist and whose nature cannot even be imagined."³⁶

Such is the eagerness of the planners to get on with the pressing work of education, and such is their apprehension that they will be too late in designing favorable environments to nurture it, that blueprints are often praised before their completion and buildings assessed even before desks have

³⁵Kansas State Department of Public Instruction, Topeka, Kansas, Suggestions for Developing Educational Specifications, 1963.

³⁶Educational Facilities Laboratories, Profiles of Significant Schools, Three Schools Revisited: Andrews, McPherson and Nova, December, 1967, p. 3.

been moved into their classrooms. Rarely are schools reported upon after they have been in operation for some time, and even more rarely are planners and administrators apprised of the effects of their advanced thinking.

Three secondary schools were selected upon which to base this study. All are considered extremely advanced educational plants, and all were reported upon generously before their doors were opened. They have been in operation about five years. Many of their innovational aspects have been proven effective. Some have not. These three schools--Nova High School in Fort Lauderdale, Florida; McPherson Senior High School in McPherson, Kansas, and Andrews Senior High School in Andrews, Texas--were built with a definite, and roughly similar, educational philosophy in mind. The concept of team teaching, combined with those of intensified individual instruction, increased use of audio-visual aids, decentralized resource facilities, and efficient environmental controls, has led architects in the direction of flexible, multi-purpose space. Library focal points, fully air-conditioned and carpeted buildings, greater use of acoustical materials, one-floor and loft plans, windowless areas, teachers' offices, and planning rooms further the innovational aspects. All three schools are inward-looking, focusing on libraries and resource centers. None is equipped with the traditional single-purpose type of auditorium capable of seating an entire student body at one time; cafeteria space is minimized or rendered multi-purpose in varying degrees; and zones of high noise-level activity are isolated from areas in which uninterrupted study is of primary importance.

In all three, economy of space, zoning of related activities, and ease of traffic flow have been basic requirements. As much as they are alike in

basic educational philosophy, the three schools vary widely in their approaches to it. Andrews is devoted to the amenities, as well as the necessities, of a good learning environment. With its central-domed concourse, its glassed-in library, and its fully carpeted floors, it is meant to relieve, as well as dignify, the serious work of education. It is, more than anything else, a kind of enclosed educational mall, hushed in tone, comfortable for its occupants, and glowing with a uniform interior light.

McPherson is the most readily expandable, but it seems the warmest, most intimate building, better adapted for materials resource centers than Andrews, not as decentralized as Nova, and certainly the most compact of the trio.

Nova is a blend of controlled learning environments and outdoor leisure areas. It is the only school of the three in which a full program of team-taught, non-graded class scheduling is supported by completely decentralized library facilities, and a sophisticated network of information retrieval and communications hardware. The schools are well suited to their environments.

With all of their innovations, however, Nova, McPherson, and Andrews have one essential factor in common with even the most conventional school house. Educationally, they are effective in direct proportion to the motivation of teachers and students.

School buildings perform their most dynamic functions as catalysts. Their individual conveniences, efficiencies, and assets as a learning environment are less significant than their roles as fulcrums of separation from the past, encouragers of the experimental spirit, instruments of propinquity for people and their tools.

In the end, a school building itself is merely a tool, a tool which can only be useful as its designers and users are skillful and highly motivated.