SPACE FOR EDUCATION

SKIP STANAWAY
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Date December, 1979
SPACE FOR EDUCATION: AN EDUCATIONAL FACILITY FOR BILLINGS, MONTANA

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

BACHELOR OF ARCHITECTURE

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MONTANA STATE UNIVERSITY
Bozeman, Montana
December, 1979
I wish to dedicate this thesis and express my appreciation to my family and Cryss. Their continued encouragement and love has made this a reality.
"Architecture implies a constant rediscovery of human qualities translated into space. Man is always and everywhere essentially the same. He has the same mental equipment though he uses it differently according to his culture or social background, according to the particular life pattern of which he happens to be a part."¹

- Aldo Van Eyck
Otterlo Meeting
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PREAMBLE

Architecture is for man. Architecture is for man to use, enjoy, and respond to. Architecture is perceived by the human senses through the aesthetic quality of space and form. Architectural aesthetics are visual, audible, emotional or any way architecture influences an individual. Man responds to architecture by three different but interrelated means: from the physical being, from the emotional being, and from the intellectual being. When architecture promotes a response, an aura seems to emanate from form and space that evokes an emotional response by effecting man's physical, emotional and intellectual needs. Without the fulfillment of man's needs, architecture is no more than the fulfilling of a predescribed, functional structure.
THESIS STATEMENT:

The major challenge of Educational Architecture is the integration of social, educational, and human needs necessary for efficient learning.

THESIS SUBJECT:

The subject of this thesis is the isolation, definition, and analysis of social, educational, and human needs and their effect upon the development of an elementary school for Billings, Montana.

DEFINITIONS:

Social Needs: those needs placed upon an elementary facility by the community.

Educational Needs: those needs placed upon an elementary facility by the educational program.

Human Needs: those needs placed upon an elementary facility by the physical and psychological needs
of the human being.

Efficient Learning: learning with the least amount of effort.
"Space itself can only be sensed, that is felt; its quality is apprehended by means of the senses, but its effect is upon the emotion, and cannot really be rationalized, measured, or depicted."²

- Geoffrey Scott
1914
INTRODUCTION

Architecture is for man. Man creates architecture for himself. Therefore, the central force within architecture is man; architecture is humanism. According to Webster, "humanism" is ". . . devotion to human welfare; interest in a concern for man. 3. a doctrine, set of attitudes or way of life centered upon human interests or values." For a building to become "architecture of humanism", the architect must center his concerns upon man. The design should be more than functional. It should evoke a response, an emotion within man by fulfilling his physical and psychological needs.

Humanists believe that architecture should have three conditions: "Commodity, Firmness and Delight." "Commodity" deals with the practical aspects the structure should fulfill, such as the activity taking place within each space. "Firmness" deals with the
mechanical aspects the structure must achieve, those being shelter and safety. Both commodity and firmness are functional conditions the building should provide. What of "Delight"? What makes a building "Delightful"? What is it, then, when all the program requirements are satisfied, makes one building "Delightful" and another simply not? To each and every one of us, "Delight" can be a different emotion, a different response. To LeCorbusier, it was spiritual. "Suddenly you touch my heart, and I say this is beautiful, this is architecture."  

I have chosen an elementary facility as my thesis project because education has such an important bearing on our lives, our attitudes, and our future in society. The architecture should enhance learning and the entire educational process. Special consideration should be given to elementary architecture for young children respond emotionally more readily to space than adults, for children have not learned to
block out the unpleasant feelings architecture produces within us each day.  

In my thesis, the areas of concern are society, education, humanism, and their effects upon an elementary facility. Society and education have needs which are functional requirements the school should fulfill, while humanism with its human needs are emotional responses to physical and psychological needs.
Part 1:

THE SCHOOL THROUGH HISTORY
The school has changed in America as the country has changed. It has changed as the educational method, the community life, and the methods of transportation have changed. During the Revolutionary period the course of study was basically the three "R's" plus Bible study and Greek mythology. The building type was a simplified version of a meeting-house, or church, with which people were familiar. The teaching was even like church, being very formal and very authoritarian. The classroom was rectangular in shape. The teacher was in front of the class for strict control and order. The school was known as a "box for learning by injection and regurgitation." After all, school was only for the privileged. The pupil would not learn or think unless impelled. The concept of learning was known as the "empty learner." Learning was based upon stimuli and a response. The learner is empty and must be fed knowledge. The
method of teaching was strictly teacher-centered. Throughout the 18th and 19th centuries, the concept of learning stayed essentially the same, but the classroom began to change. Horace Mann, an educational theorist, brought on a new idea in teaching. For education to be complete, you must educate the body as well as the mind. Science was introduced, and a concern for the human body. Chief emphasis was placed upon heating and ventilation. Schools began to be concerned with the child and the child's health. Standardized seating was developed with adjustable seats and desks. The rectangular classroom with its large class of straight rows and wide windows was intended to provide ventilation, light, quick departure and ease of surveillance. It was during this period that the traditional dislike for schools probably developed, because of school conditions. Fire and accidents on stairs, along with poor sanitary conditions were because of poor safety conditions. The
school was only used during daylight hours, so no artificial lighting was needed. The architect was not expected to design the school for other uses.

In the early 1900's, school designs began to address the problems of safety and the modification of the child as the learner. The front of the classroom was determined by window location to eliminate eye strain. Windows were to be on the left side of the class to bring light over the left shoulder. The child was thought of as an "active learner." He was not an empty organism. The child is a bundle of needs, values, persuasions, projections, and repressions. The teacher moved her desk from the front of the class to the side or back, which enhanced the concept of the pupil-centered school.

As time progressed, the pupil-centered school concept saw total change in educational philosophy developed by John Dewey. It was the graduation from "book learnin'" to "learn by doing." There was no
longer the static desk-teacher relationship and all furniture became mobile. Schools were designed according to function and were designed for the child. Architecture began to be concerned with the child's intimate scale and the effect of color on the child. Schools began to decrease in size and respond in harmony to the size and activities of the child. Schools were not to be institutions and were bare of ornament, with large window areas and simple forms. This developed into the "social learner" concept with its circular classroom. Each person in class served as a stimulus to the other for learning and increased awareness of the group climate. Classes became more informal with emphasis on the outdoors.

The school and education have now progressed to the open classroom: the "stimulus-seeking learner" concept. There are several progressions of the open concept, but all have the same philosophy. The child should have a sympathetic effective interaction with
the environment. The school should provide a level of excitement with sensory stimulation. The child has basic needs of problem-finding and is a stimulus-seeking organism. In the traditional classroom, the child would learn exclusively at his desk. In an open school, the focus of learning is individual where there is something of particular interest to the child. Teaching requires more skill and attention to the child than the classical approach. The main purpose of open education is to tell the child who he is to be and how he is to learn.

Schools now demand more from the designer. Schools should enhance learning, enhance the community, and enhance the child.
Part 2:
NEEDS
School architecture has needs placed upon it by society, the educational program, and the human being. Society places demand upon the school facility because the school serves the social community. They are the people attending the school and are those affected by the school. Educational needs must be dealt with in school design because the main function within it is to educate the children of our society. The school should also respond to human needs because the structure is built for human use and they are the prime and only users of the structure.

In this part of my thesis book, I wish to take social, educational, and human needs, and attempt to isolate and analyze their effect upon an elementary school facility. The first section deals with social needs and looks at their influence upon the school. In the second section, I discuss educational needs. They are the needs placed upon the school by the
educational program. In the third section, I discuss human needs and analyze what influences them and how the environment within a space can affect a child in the learning process.

Society is dynamic: developing different needs, goals and desires. Education is dynamic: ever changing in content, method and concept. Architecture should be dynamic: solving not only social and educational needs but human needs.

SOCIAL NEEDS

Every building which exists today has certain social needs it must fulfill. Social needs are needs placed upon the facility by the community. The building should not only serve the demands of its internal users, but also should serve the demands placed upon it by the community. Architecture is designed for humans and should respond sensitively to their needs.
as individuals and as a human society.

SOCIAL NEEDS - The Community School

In school design, the community needs and the need for better schools can be answered together in the design of a new multipurpose school facility. The school can be a place in which education of children and activities of the community occur alternately or simultaneously. Events such as senior citizen entertainment, community theaters, social services, and recreational activity can all be part of the services the school can provide. Whatever the need of the community, the school is a good partner because no other public building has as much local influence upon the neighboring community as the school.

If the school is open more hours of the day, serving more people of the community, the effect upon it is great. Vandalism of the school will go down because more people will be using it and taking pride
in "their school". The community will be available for a variety of federal money programs and will see bond issues pass more readily since the school will be affecting more of the taxpayers.

SOCIAL NEEDS - Capable of Change

The school must be able to change with the ever-changing society. As the society changes, so will the demands placed upon the schools and therefore the school should be able to respond to these new demands. When the educational method, community life, and transportation methods change, the design and patterns of school buildings must change with them. The school is a reflection of the social change of the community. School design should keep pace with education innovation by providing for constant revisions of teaching methods and equipment.

Man in society today wants, needs, and actively seeks an education to prepare him to cope with the
increasingly complex, and ever-changing society. The school should respond to these demands.

SOCIAL NEEDS - Active Role in Social Environment

The school plays an active role in the social environment of the community. Schools are influenced by the neighborhood; they in turn will influence the neighborhood. The size of the school can determine the neighborhood size. Children of the school seem to be the prime movers in the establishment of social relationships in the neighborhood. The school has key roles to play in the social development of the child. "Architectural spaces, then insofar as they influence privacy and communication, share a large responsibility for the individual's general sense of well-being and for his outlook upon society." Children can understand themselves as part of a larger social unit by structure and arrangement, by supporting the sharing process with cooperation.
rather than competition and through the arrangement of work spaces to help the interaction among the children. The school must serve a large social need, the feeling of security and affection.

Because more parents are working, the school must take on some of the duties of the home. Parents and school should work together to reinforce learning and to develop the child's verbal abilities.

SOCIAL NEEDS - Involvement in School Planning

The user of a building is anyone whose life is affected by it. In school design, the user would be the school community and the entire community at large. The users should contribute to the definition of the skills and behaviors used within this environment. Schools need support and input from parents, community residents, students, and teachers. They should all become involved in the planning and work together with city and government officials, such as
the Physical Education Department, the Health Department, and the Social Welfare Organization.

**SOCIAL NEEDS - Social Economics**

The school building program is in an era of retrenchment caused by inflation and declining enrollment within the school districts. Therefore, the users should get more from the building. It should serve the entire community and be more than just a place for children. School designs today are usually controlled by minimum costs, minimum maintenance, and minimum social controversy. Energy conscious design is becoming a key factor in school planning. With all of these restraints placed upon the school, the maximum benefit to the child and community from the school may be lost. Special care should be taken so the restrictions should not interfere and should allow the school to become a place to learn, grow, and experience the world for the child, and yet
EDUCATIONAL NEEDS

The educational program within our elementary schools has changed throughout the years. The teacher is no longer at the head of the classroom lecturing to the student. The students now learn by experimentation and from each other. Since the educational program has changed, the design of new schools should change to enhance and support the new educational program.

EDUCATIONAL NEEDS - Educational Goals

Learning for a child is through contacts with nature or human beings. Education should control these contacts by selecting, regularizing, and intensifying their effect upon the child. The school and its program have several objectives for the development of the child. The school should help the child become a responsible and enlightened person while at
the same time developing essential skills. The pro-
gram should develop in the student the capacity to
evaluate and practice basic virtues, such as respon-
sibility, honesty, and consideration for others. The
school should employ a balanced program for work, rest,
recreation, adequate diet, health exams, and support
a sociologically wholesome personality development.
Many of these used to be done in the home but because
society is changing, the school may have to assume
more and more of these responsibilities. The goal
within each classroom is to develop basic skills in
the child and provide for opportunities in which
these skills would be exercised. The classroom
should promote social, physical, and emotional growth.
Education should be useful to the child by developing
the concept that learning is a continuing process
beyond the school because the purpose of education is
to produce adults who no longer need teachers, but
who know how to educate themselves—human beings who
will continue to be self-renewing learners for the rest of their lives.

EDUCATIONAL NEEDS - Flexibility

Educational planning is the most difficult to satisfy for all elements with which it deals are people problems. One of those is flexibility. What is flexibility? Flexibility means: "convertible; adaptable; divisible; sub-divisible; moveable; removable; changeable; multi-purpose" and the list can continue. Even though the definitions are numerous, they all deal with changes of space. Change of space in a school should be able to occur overnight, in a class period or even instantly. When contemplating flexibility in school design there are several questions to be considered. Are individual study areas needed? Are seminar-sized rooms and teachers' counseling areas needed? Are learning spaces for closely related subject areas grouped together so common facilities can be used? Is there a balance
of large, medium, and small group spaces? Is each space efficiently used? Is the facility available for use after normal school hours? After considering the questions, it is realized that flexibility should be built into the spaces to satisfy the needs of groups of various sizes and interests.

EDUCATIONAL NEEDS - Advancement of Technology

Technology has had a major influence upon the education program within our schools. There has been extensive development and use of all media equipment. The resources include closed circuit television, computer-assisted instruction, taped instruction guides, and other media. Television cannot take the place of the teacher as a machine cannot counsel, assist, direct, inspire or solve the hurt feelings of a student but planning of schools with television can improve book teaching and learning. Technology has improved large-group instruction and more individual-
ized instruction in certain areas of education. Technology has made it possible to bring experience and information from every realm of life directly to the student.

**HUMAN NEEDS**

Human needs are the most difficult to define. When dealing with architecture, human needs become both physical and intellectual. I have defined human needs as the physical needs, representing the functional and psychological needs, representing the intellectual needs of the human being. In architectural design, most of the physical needs are accounted for during programming. Questions such as, "What spaces are needed for the building to function?" are answered by defining the space, which I have dealt with in Part VI. For architecture to become more than space and problem solving, the space should be designed for the needs of the human mind. This is what distinguishes
architecture from simply being a "building". Architecture should serve every function of structure and utility and at the same time serve the emotional and intellectual desires of the user.

HUMAN NEEDS - Child Behavior Characteristics

The child has some certain behavioral characteristics which affect the design of his/her school facility. The child has his/her first contact with formal education in the elementary level at the age of five or six years and continues to learn in that environment until the age of twelve years. The children during the elementary years exhibit acute senses of perception. They see, hear, smell, taste and feel stimuli which older children ignore and the younger miss. The child is very curious although the younger the child, the shorter the attention span. At the age of nine to ten years, the child is capable of absorbing more education than is presently being
offered to him.\textsuperscript{15}

HUMAN NEEDS - Physical Activity

During the elementary years, the child has a desire for physical activity. Physical growth and physical activity are major concerns in the development of a child's mental and physical well being. Since movement is essential to learning in childhood, the child needs room to move, explore, experiment, and discover. Learning to the child involves overcoming obstacles and gaining new skills through exercise and development of coordination. Space for activity is needed both indoors and outdoors. The need for an appropriate physical environment will provide many opportunities for physical activities.

HUMAN NEEDS - Learning

The learning process of an elementary school age child is changing. Until now, learning has been "sit and learn". Learning becomes easier and better
for the child when actually involved in the process. The architecture should respond imaginatively to that demand. Learning should be active and should not be separated from the social life of the child. Learning should be natural and should occur both inside and outside the controlled environment. Learning should be fun to the child. Seeing, hearing, and the ability to respond to stimuli are all basic needs for learning that most children possess and therefore should be developed further throughout their education. The atmosphere and environment of the school should encourage learning with enthusiasm and pleasure for the child.

HUMAN NEEDS - The Environment

The immediate physical environment has a great influence on organizational life. We are a product of the environment and it affects how we relate to others because we act and communicate as our surroundings direct.
Children are sensitive to space, more so than adults, and respond to many kinds of places. Cozy places, big spaces, open spaces, small spaces, and private spaces are all places where children will react differently. The right kind of space creates activity for play, make believe, and fantasies. In a tunnel, no child will only crawl to get to the other side, they will create things to do, to think about, and to talk about. Wasted space can become a learning tool for a child. Stairs, landings, small corridors, and closets can all be places for students to meet, talk, study, and dream. Children need places for being alone, and for small group activity. The child also needs space for public, semi-private, and private activity.

The physical surroundings of a school will contribute to the child's emotional and social development and physical safety. Structured space has a profound effect upon an individual's emotional state,
individual personality, and in turn is affected by these. It should give a feeling of security and intimacy yet not restrict activity, only enrich experience. Comforting beauty is what children need. Human charm and human scale are essential with an atmosphere not too far removed from that of home. The school should be childlike where used by the child, not what adults think childlife is because school architecture is a setting for childlife. The child has a need for communion with nature, a contact with the outside, and stimulus variation.

School should be a relaxed learning experience. The building itself should play a role in the learning process. The child should use his/her five senses and learn from them by allowing the child to respond to scale, proportion, and texture. Color can control reactions within a space with "quiet colors" and "noisy active colors". In the primary grades, the pupils thrive on excitement. They bene-
fit from the stimulation of cheerful, bright areas of color. Sense of space can have the same effect by allowing high ceilings to give a sense of freedom and physical activity and low ceilings for quiet activity. Good scale is vital to a good school environment. The child should be able to relate to the relationship of room and building size, yet the scale must be sensitive to both the child and the adult. The environmental lighting with its variation in type and quantity can also affect the sensed space and its scale, as can a variety of spacial effects, and the natural and textural qualities of materials used.
Part 3:

THE SCHOOL
PART III - THE SCHOOL

So far, I have attempted to isolate, define, and breakdown those needs I feel are important and possess qualities that may better school design. The following are excerpts from a letter written to Eliel and Eero Saarinen and Perkins, Wheeler, and Wild, the architects of the Crow Island School in Winnetka, Illinois. The letter was written by Frances Prosler, the Director of Activities for the school. To me it sets the goal for all elementary schools now and in the future and enhances my feelings that a school should be more than a place to learn the three R's. The school should be a place to live, learn, react, and experience. The values this letter expresses have provided inspiration to me and are held within my final solution.

THE SCHOOL - A Letter to the Architects

"Your question, 'what spirit shall it have? --
That is what is important, will not let me rest. On and on my mind runs trying to answer you. And now that I have seen the interior of buildings you have made and seen that you can build specific spirit with landscape, brick, wood, metal, glass and textile; with shapes and masses and strips of color, may I share with you my thoughts and feelings of what our school building should really be?"

"All the architecture shall be a setting for childlife. Everywhere children and what they can do shall be the adornment of the structure. The building itself shall be the place of joy in living. But I must warn you. It must be a place which permits the joy in small things of life and in democratic living. These two things we must safeguard in children's lives. The building must not be too beautiful, lest it be a place for children to keep and not one for them to use. Its materials must be those not easily marred, and permitting of some abuse. The
finish and settings must form harmonious background with honest child effort and creation—not one which will make children's work seem crude."

"Above all the school must be childlike—not what adults think of children. At the same time, it should be dignified and playful, but not a playing down to children. It must be a place for living, a place for use, good hard use, for it is to be successively the home, the abiding place for a procession of thousands of children through the years. It must be warm, personal, and intimate, that it shall be to each of these thousands, "My school".

"It must be inspiring— with a beauty that suggests action, not passiveness on children's part. Yet it must give children the feeling of basic rightness and fitness, that gives them belief that they too can be, act, and create, and that they, their action and creation are needed."

"The school should look to the future. It
should not seem complete and finished beyond any addition of adjustment to later demands. It should give children and adults the feeling of flexibility, possibility of change. This is the germ of growth. And rigidity of architecture can cage the energy, and irritate the spirit of those who live within.

"The classrooms shall express inner tranquility which can be sustained. The atmosphere of these rooms which particularly are the school homes, should give feeling of security. These are especially the places of living together and should give feeling of inviting home-likeness, settings in which constant, confident realization of self and others together can take place. A place not too good to be true—one which small persons can feel will endure.

"The assembly . . . is the one part of the building in which all come together simultaneously, obviously and consciously to form the school body as a whole. . . . Frequently the experiences taking place
there are exhilarating, lifting and stimulating emotionally. The room must therefore have dignity for large group consciousness' sake. It must be buoyant for emotion's sake. But it must not be adult, sophisticated or over-stimulating. It may awe slight—for children must be lifted to levels they did not know were inside. These levels they cannot and should not sustain for long periods. Therefore as a setting it may take the breath a bit as one enters—not just on the one first view, but with each entrance."

"Color treatment it seems to me can be the means of bringing in some elements of intimacy and surprise. This form of decoration can be such that one makes the discovery as a personal experience. That I believe has value for our purpose. It will help children feel an artistic ownership in their building."
common with the assembly. They, too, are general school rooms—though not for all the school simultaneously. The art room should lead children to confidence in an exploration of themselves. In beauty it should urge and stimulate to creation. Again the beauty should be a background setting kind, and one not too finished, lest children feel it beyond them to make contribution."

"The library I would designate as a place for "lingering with energy". A place for storing enrichment which at later time and place will find outlet and expression. Here again we need a setting. This time a setting for children and their books. . . ."

"Adult rooms like principal's offices, teachers' restrooms, conference rooms should, I would think, be kept in harmony with the rest of the building, but could definitely express adult rather than childlike atmosphere. . . They should express the rightness and place of adults within the child's world rather
than the usual reverse situation, an acceptance of children in the adult world."
Part 4:

"MY KIND OF SCHOOL"
PART IV - "MY KIND OF SCHOOL"

Throughout my writings, I have stated that the school is for the child. The child is the primary user of the school. I feel that the user should have some input to the school design. Too often, school directors and administrators feel they know what the child wants and try to answer for the child. This can be exemplified by a school designed by what an adult thinks is childhood and not what life really is to a child.

To bring child input to my school design, I went to the sixth grade classes of the Arrowhead Elementary school in Billings. I was introduced to the classes and given most of an afternoon to talk with the children and develop ideas about school designs. I asked all of the children to give me their ideas of what they would like in their school. There were no limitations as to what they could put in their school. They were the architect. After asking many
questions, the eager sixth graders got out their paper, pencils, and magic markers and proceeded to work on their design. Some schools were designed with features such as: a "big foot hunting" area, motorcross tracks, and teacher torture areas. However, most of the children gave me ideas of what they would really like in "their" school environment.

One of the main concerns to the children was that of comfort. They wanted their school to contain "classy classrooms" with areas full of overstuffed chairs, plush rolling chairs, and bean bag chairs. They wanted areas and furnishings that would make them feel relaxed and untroubled.

The children wished their school to contain spaces where they could be alone. Areas such as a children's lounge or courtyard with a reading area were desired. They wanted a place where only children were allowed. The children wanted a place where they could get away from adults and the other
children and be secure within themselves.

Through their drawings, the children expressed the need for areas and spaces within the school to create different environments. Such ideas as circular rooms with slides between them, classrooms with overhead walkways between them, classrooms with a second story level, or classrooms with patio areas off of them, all express a desire to have areas where the child has an opportunity to feel the different emotions a space allows.

The children also designed their schools to contain many areas with natural environments. Many designs contained space full of trees and natural vegetation. Some expressed the need for courtyards with "sliding glass doors" or "open at the top". The children expressed a desire to be aware of the natural environment by having many windows and one design even contained windows all the way around the school. Many school designs contained a pool or pond.
where they could have "frogs, fish, and turtles" which would be surrounded by a "chip or brick path". One child felt the library should be "a spot where you can read and relax and it has a grass floor with an open roof covered with glass in the winter and can open it in the summer."

The children felt their school should provide full recreational activities. Most of the designs contained swimming pools, large gymnasiums with locker rooms, and large playground areas. The children wanted the school to provide more services to themselves and the community. This was expressed by one child who commented, "pupils can use the gym in the evenings and on weekends if they get good grades".

By allowing the children to become involved in a school design of their own, I was able to learn more about the elementary-age child and the feelings they need to express.

I would like to thank the Arrowhead Elementary
School sixth graders of 1979 for their input and the faculty for their ideas and comments regarding their school and this study.
No teachers allowed!

a. classroom
b. desks
  ▲
c. slide.
d. swimming pool
e. gameroom (disco floor!)
f. lockers
g. teachers
h. track field
i. roller skate floor

Rules
T.V.

Funny looking whirlpool

Skating rink

Tennis court

Diana Acevedo

Arrowhead School

For kids

DISCO

For teachers

Enter your choice

Exit
Part 5: THE SITE
PART V - THE SITE

The City of Billings is one of the fastest growing cities in the State of Montana. A major reason for this increase is the energy resource development within the eastern part of the state, namely coal development. Because of the increase in population and the city's growth, more schools will be needed in the future. For this reason, I have chosen Billings for my school site.

Billings, at an elevation of 3,100 – 3,600 feet, is situated in the borderline area between the Great Plains and the Rocky Mountains and has a climate which takes on some of the characteristics of both regions. One third of the annual precipitation falls during May and June. The period of least precipitation is from November through February. Snow six inches to one foot is not uncommon during the winter months. Snow seldom accumulates to great depths on the ground because of the occurrence of thawing.
periods. Heaviest snows occur during the spring and fall months. Prevailing winds are from the southwest with the worst storms coming from the northeast. In the summer months, days are warm with lots of sunshine and low humidities.\(^\text{16}\)

The population trends of Billings call for a substantial increase to the year 2000. The projected population within the urban area of the city calls for a growth of 87\%. The major growth areas are the west end (east of Shiloh) and the Billings Heights area (west of Main Street).\(^\text{17}\)

Currently there are four elementary schools serving the entire Heights area and a fifth under construction. These present schools are so overcrowded, students from the area are bussed to other schools throughout the Billings area. Many schools near the central core of the city have seen a decline in enrollment due to the shift in the city's growth. The Committee on Population Trends estimates by the
In choosing an appropriate site for my school, I looked to the Heights area. I was looking for a site that would not only serve the school facility, but would be large enough to serve the recreational requirements of the area. The Heights is currently lacking parks for recreation use. The site I have chosen is bordered by Rice Lane and Lake Elmo Drive to the south and east, respectively, and undeveloped land to the north and west. It is situated within a residential setting, a factor to be considered in the design solution. A school at this site would be within a major growth area and still conserve the "neighborhood concept." It is a concept adopted in Billings meaning the attendance area of the school would be less than one-half mile radius. The population of this area is estimated to increase 161% from 1980 to the year 2000.
This site is optimum for a school location. It is located off a main arterial street yet allows for good access from it. The main access to the site is bordered by existing trees and vegetation which would act as a natural barrier for street noise and visual distraction. Large mature trees also border the site to the west. The site, being situated with an east-west orientation, allows for good solar influx. The topography of the site is basically flat, which is optimum for use as a recreational area.
Part 6:

INTEGRATION OF NEEDS
PART VI - INTEGRATION OF NEEDS

Thus far in my thesis, I have discussed many considerations in school design. The next step is to formulate those considerations in a design solution, a process I label "Integration of Needs".

School Design Considerations

The school should be a place where people want to go. It should draw people within it. The children should want to go to school to learn, experience, and enjoy life. The school should be close to the community. They should feel it is theirs and want to use it for more than an educational facility for their children.

The materials used for the new school should endorse the desired feeling of warmth and friendliness. The external materials should have a low maintenance factor yet relate to the residential area of the site. The internal materials should require
little maintenance and upkeep. From a study of existing school facilities, the school district confirmed that materials with a long life expectancy would be preferred over less expensive alternates.21 The sub-committee also found existing facilities lacking storage of materials. This is especially true where kitchen facilities were involved.22

Handicapped access to all areas of the school is also a main consideration. This should be true for both the elementary school areas and the community use areas.
BUILDING PROGRAM

Space Requirements -- 400-500 students

General Learning Areas

Kindergarten

Learning Area  900 sq. ft.
Coat Storage  50 sq. ft.
Indoor Activity Area  200 sq. ft.
  - access to outside area
Art Center  75 sq. ft.
  - sink and wash area
  - storage
Book Center  100 sq. ft.
  - reading area
  - display area

Total  1325 sq. ft.

Design Considerations: The kindergarten area should provide each child with as many and varied experiences as possible. It should be carefully located because of the noise activity within the area. It should have a visual link and a direct access to the outside without having to pass through other learning areas. The space should allow for easy supervision and flexibility. The environment should be child scaled with an atmosphere to be healthy, pleasant and
stimulating. A south orientation is preferred for controlled sunlight and direct heat gain. The access should allow for constant floor activity. The activity area should be able to be darkened for rest periods.

Learning Area - Grades 1 and 2

<table>
<thead>
<tr>
<th>Description</th>
<th>Area Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Area</td>
<td>6 @ 800 sq. ft.</td>
</tr>
<tr>
<td>(120-130 students)</td>
<td></td>
</tr>
<tr>
<td>Coat Storage</td>
<td>2 @ 100 sq. ft.</td>
</tr>
<tr>
<td>Washroom Area</td>
<td>2 @ 150 sq. ft.</td>
</tr>
<tr>
<td>- sink and wash area</td>
<td></td>
</tr>
<tr>
<td>- storage</td>
<td></td>
</tr>
<tr>
<td>Common Area</td>
<td>500 sq. ft.</td>
</tr>
<tr>
<td>- area for group activity;</td>
<td></td>
</tr>
<tr>
<td>storytelling, reading,</td>
<td></td>
</tr>
<tr>
<td>lounging, etc.</td>
<td></td>
</tr>
<tr>
<td>- darkened for audio-visual use</td>
<td></td>
</tr>
<tr>
<td>- accoustically separated from other areas</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5800 sq. ft.</td>
</tr>
</tbody>
</table>

Learning Area - Grades 3 and 4

<table>
<thead>
<tr>
<th>Description</th>
<th>Area Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Area</td>
<td>6 @ 800 sq. ft.</td>
</tr>
<tr>
<td>(120-130 students)</td>
<td></td>
</tr>
<tr>
<td>Coat Storage</td>
<td>2 @ 100 sq. ft.</td>
</tr>
</tbody>
</table>
(Grades 3 and 4 - con't)

Workroom Area 2 @ 150 sq. ft. 300 sq. ft.
- sink and wash area
- storage

Common Area 500 sq. ft.

Learning Area - Grades 5 and 6

Learning Area 6 @ 800 sq. ft. 4800 sq. ft.
(120-130 students)

Coat Storage 2 @ 100 sq. ft. 200 sq. ft.

Workroom Area 2 @ 150 sq. ft. 300 sq. ft.
- sink and wash area
- storage

Common Area 500 sq. ft.

Design Considerations: The learning areas should be located away from noisy areas of the school and exterior noises. Noise from one learning area to another is also a critical factor. It should have easy access to the library, administration area, conference specialists' area, health center, and playground area. Each learning area should be able to be divided into smaller units. The learning area should be large enough for different learning stations. The areas should provide for maximum storage and display area. The areas should have a stimulating environment with colors, textures and forms. A south orientation is optimum to
allow for controlled sunlight and direct heat gain. A visual link to the outside environment is preferred.

Library Materials Center

<table>
<thead>
<tr>
<th>Area</th>
<th>Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Area</td>
<td>1250</td>
</tr>
<tr>
<td>- stacks, displays, study</td>
<td></td>
</tr>
<tr>
<td>tables, librarian's desk</td>
<td></td>
</tr>
<tr>
<td>Library Workroom</td>
<td>260</td>
</tr>
<tr>
<td>- copy equipment, teacher</td>
<td></td>
</tr>
<tr>
<td>work area, storage</td>
<td></td>
</tr>
<tr>
<td>Media Center</td>
<td>250</td>
</tr>
<tr>
<td>- area for study carrels,</td>
<td></td>
</tr>
<tr>
<td>video-viewers, other media</td>
<td></td>
</tr>
<tr>
<td>equipment</td>
<td></td>
</tr>
<tr>
<td>Reading Area</td>
<td>1400</td>
</tr>
<tr>
<td>- for individual reading,</td>
<td></td>
</tr>
<tr>
<td>lounge space, large group</td>
<td></td>
</tr>
<tr>
<td>storytelling</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3160</strong></td>
</tr>
</tbody>
</table>

Design Considerations: The library should be in a location so as not to be disrupted by outside or inside noise yet accessible from all learning areas. Extreme variations in lighting should be avoided. The space should be designed for flexibility and easy supervision. The atmosphere should not seem institutional, and provide a stimulating environment.
for individualized learning.

Specialized Learning Areas

Music Center 1200 sq. ft.

Design Considerations: The music center is a place to make music and learn about it. Children will sing, move, play instruments, read music, and make music. The center should be flexible with no fixed furniture and allow for storage of all music equipment. The environment should be designed for proper acoustics and noise control. It should be located close to the multi-use areas yet easily accessible from all learning areas.

Conference/Specialists Area 650 sq. ft.

Design Considerations: The space should allow for both individual and group assistance. The area should be located close to the library center, protected from any noisy activity, and easily accessible from all learning areas. The atmosphere should contribute to the growth and maintenance of a positive mental attitude.

Administration

Administrative
Reception/Secretary Area 400 sq. ft.
Principal's Office 150 sq. ft.
Auxiliary Office/Conference 150 sq. ft.
(Administration - con't)

Conference Room  
(15 people)  
300 sq. ft.

Storage Room  
200 sq. ft.

Total  
1200 sq. ft.

Design Considerations: The Administration area should be easily accessible to all school personnel and visitors. It should be close to the Health Center, staff Lounge, and the main entrance of the school. The space should be aesthetically pleasing to create an atmosphere of warmth and friendliness.

Health Center

Waiting Area  
100 sq. ft.

Examination Area  
200 sq. ft.

Rest Area  
150 sq. ft.

Toilet  
50 sq. ft.

Total  
500 sq. ft.

Design Considerations: The Health Center should be located in a quiet area near the Administrative area and easily accessible to parents and pupils. The space should create an atmosphere of a warm and relaxing environment.

Staff Lounge  
(40 capacity)  
Dining Area  
450 sq. ft.
Design Considerations: The lounge should be easily accessible from all parts of the school. It should be isolated from the child areas and close to the staff washrooms. A visual link to the outside is desirable to act as a visual diversion. A direct outside access is optimum. The space should create a pleasing environment for adults to relax and visit.

Community Use Areas

**Food Service Area**
- Kitchen 300 sq. ft.
- Food Storage 250 sq. ft.
  frozen and dry food

**Multi-Use Area** 3500 sq. ft.
(400 capacity)
- Stage Area (portable) 500 sq. ft.
- Table and General Storage 450 sq. ft.

**Total** 5000 sq. ft.

Design Considerations: The multi-use area will serve as a dining area and large group activity area for the school and community. The space should provide a relaxing environment for musical activities,
film viewing, and special events. It should be located away from quiet areas and easily accessible to the music center.

Physical Education Area

Gym Area 8800 sq. ft.
- Official Size Basketball Court
- 2 Junior High Courts

Locker Rooms 2 @ 800 sq. ft. 1600 sq. ft.
- Men's
- Women's

Gym Storage 150 sq. ft.

Total 11,900 sq. ft.

Design Considerations: The Physical Education area should be located away from any quiet areas of the school. It should have direct access to the recreational areas and easy access for after-hour use.

Service Areas

Mechanical Space 1500 sq. ft.
Storage/Receiving 400 sq. ft.
- direct outside access
(Service Areas - con't)

Toilets

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 @ 150 sq. ft.</td>
<td>300 sq. ft.</td>
</tr>
<tr>
<td>Men</td>
<td>2 @ 150 sq. ft.</td>
<td>150 sq. ft.</td>
</tr>
<tr>
<td>Women</td>
<td>150 sq. ft.</td>
<td></td>
</tr>
</tbody>
</table>

Design Considerations: The children's toilet facilities should be centrally located for easy access from all areas. The men's and women's facilities should serve for school faculty and for after-house public use.

Janitor's Room 2 @ 100 sq. ft. 200 sq. ft.

Total 3000 sq. ft.

Facility Total 46,675 sq. ft.

Site

School Parking/Loading Area
- for visitors, faculty
- serve as community use parking after hours

Recreational Use Parking
- for use of recreation area
Recreational Use
  Football/Soccer Field
  Baseball Field(s)
  Park Area

School/Community Playground
COMMUNITY USE AREAS

AREA RELATIONSHIP

COMMUNITY USE AREAS

Physical Ed.

Multi Use

Health

Liberty

Admin

Kindergarten

Learning Center

Learning Area

Learning Area

Learning Area

Service

Music

Image

Graf
Part 7:

THE DESIGN
PART VII - THE DESIGN

Concept

I first began my design by looking at the site and organizing the various functions that would respond well to the site limitation. After developing a first scheme that did not respond to the site or my thesis statement, I realized the best placement of the school would be in the northeast area of the site behind the existing trees. This would allow for parking and the landscape to become a buffer for street noise and traffic. It was a main consideration to contain the school building within a limited area to allow for the open space to be used for recreational activities. With the building placed on the northeast area of the site, all recreational areas would be in sunshine the entire day without any shade from the school and provide an east-west orientation for solar gain in the learning areas of the school. It would allow for easy access to the school.
from Lake Elmo Drive on the east, and easy access to the recreational areas from Rice Lane on the south.

The learning areas were the first areas of the school to be developed. They were formulated into four "learning modules" consisting of grade groupings: Kindergarten, 1st and 2nd, 3rd and 4th, and 5th and 6th. This would allow for easy interaction among grades in the learning area, minimize long corridors, and allow for accoustical separation between each learning area. The organization of the learning areas was developed to provide for an open-classroom concept or a semi-open learning environment. This led me to a 30' x 30' grid for the learning areas. They were organized for easy interaction among learning areas of the same grade and those of the same general age. The height and length of the partitions between the learning areas would control the amount of open space and interaction desired. By allowing the circulation space to flow around the learning
areas, the circulation space can be used for displays, exhibits, and serve as the workroom space, easily accessible from all areas. The common area then became the focal point of the learning areas.

At this time I began to impart the sense of humanism to the scheme. Each area of the school began to flow to the outside and back again with the use of glass and plane relationships through my initial rough sketches, implying a link to the outside world. As the design developed, I remained conscious of the use of light to the space, the form of each space, and materials of each space to enhance space variety, movement, and promote a response within the user. As each area evolved, the sense of humanism became the basic concept of the final design.

Design Refinement

Because of the size limitation of the school put upon it by the site, I employed a two-story
scheme. This not only provided more area for recreational use, but also allowed for a greater variety of spacial experiences for the child.

When approaching the entrance to the school, a sense of activity would be felt by allowing the interior space to be seen from the entrance and would expand the interior space to the exterior through the large glazed area of the lobby space. Upon entering the lobby space, a visual view of the entire facility would be possible to provide a visual expression of the different spaces, forms, colors, and textures to be felt and responded to. The lobby space separates the educational areas from the community use areas and allows the circulation to flow from it to the library, administration, learning areas, and community use areas. The library center became the hub of the learning areas with a large two-story space and promotes a variety of emotional experiences.

An atrium-type setting within the library brings
the outside environment directly to the child and creates a sense of focal activity within the school. The reading area is sunken to provide greater separation from other areas of the library and the circular stair from the ground level to the second level creates the space for the group activity area. A large skylight and clearstory lighting would provide most of the light needed in the library and pass through to the learning areas. On the ground level are located the kindergarten and 1st and 2nd grade learning areas. Each learning area is oriented to the south for natural light and direct solar gain to heat the floor of the common areas. The heat gain on the carpeted floor area would provide a warm surface for floor activity. The community use areas are easily accessible from the lobby space and the activity within each space is carried visually to the lobby space and the entire school through windows of rectangular and circular shape. The windows would
be child scale located close to floor height and become an "eyeglass" to see the activity within each space (a concept use throughout the facility).

On the second level is the music center and the 3rd and 4th and 5th and 6th grade learning areas. They are oriented to the south and the east to be protected from the harsh west light. A south orientation also provides heat gain into the learning areas and common areas. During the periods when solar gain into the common areas become too obsessive, a sun screen would be pulled down in the 1st, 2nd, 3rd and 4th grade learning areas and pulled across in the kindergarten and 5th and 6th grade learning areas. The screens would also serve to darken the common areas for audio-visual use. The music center and lavatories would be the only community use areas on the second level.

The basic material of the school facility would be jumbo brick on concrete block or jumbo brick with
vinyl covered gypsum board. The brick would relate to the residential setting the school is set within and the gypsum board allows for variation of color on the interior and becomes tack space for the school areas. The structural system exposed in some areas allows for hanging graphics of different color and form. The floor material of the school would be carpet and ceramic tile within the entry areas and areas of coat and "mud storage".


9. Ibid., p. 4.


12. Ibid., p. 7.


15. Ibid., p. 8.


18. Ibid.

19. Ibid.

20. Ibid.


22. Ibid., p. 2.
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MSU Media Center

Ted Wessel, Principal
Arrowhead Elementary School, Billings, MT

Teacher Faculty
Arrowhead Elementary School, Billings, MT

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MSU Media Center

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MSU Elementary Education Department

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