ABSTRACT
        School facilities play a significant role in shaping
students' learning process. This document is a collection of articles that
examined the impact of school facilities on learning. The articles were
previously published in Chinese during the early 1980s in Hong Kong
newspapers. Contents include: (1) "A Summary Report on the Relationship of
School Building Age and Student Achievement"; (2) "School Design and
Instructional Need"; (3) "Learning Environment and Student Achievement"; (4)
"My View on Learning Environment--A Rejoinder"; (5) "Three Studies on School
Facilities"; (6) "Environmental Psychology and Facility Planning"; and (7)
"Educational Facility Research in America." (Contains 25 references.) (LMI)

Environmental Impact
on
Student Learning

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1996

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A Word To Say.......

In my years of work experiences and research effort with school facilities, I have no doubt in my mind that school facilities play a significant role in the students' learning process. Studies performed previously have investigated student performance, achievement and attitudes and their relationship with different school facility variables.

This facility-learning "interface" as described by Dr. Harold Hawkins were addressed in several articles I wrote both in Chinese and English languages. This manuscript is a collection of articles about the impact of school facilities on learning I previously published in Chinese language. These articles have been carefully selected, annotated and translated into English for the use of English language readers. Though they were published in the eighties, the theories behind these articles are still widely adopted. All the articles have been highlighted with footnotes which were added on during the translation process. These footnotes will help clarify some of the points made on the background of different facility planning situations. A summary reference sheet is also included for the readers' information.

February, 1996.

T. C. Chan

Contents

A Summary Report on the Relationship of
School Building Age and Student Achievement

Modern school buildings are able to meet the needs of educational programs today because they incorporate the latest innovative ideas and technology. On the other hand, facilities in old school buildings are obsolete and cannot meet the current educational needs without major renovation (see Footnote 1). It goes without saying that old school buildings cannot compare with new ones in terms of facility qualities.

The rise of material and labor costs results in the increase of prices in school construction. Consequently, many school building projects have been either delayed or reduced in the scope of work (see Footnote 2). School facility planners have been very concerned about this recent trend and been working hard to research on the relationship of school building age (see Footnote 3) and student achievement. They hope to seek evidence in support of new school construction. If findings indicate higher student achievement as a result of students housed in newer school buildings, then it will lend a great deal of support to school construction projects to counteract the economic pressure.

The theoretical basis of the American facility planners is: Man shaped by his environment will be more knowledgeable to create a better environment (see Footnote 4). They believe that environment has an impact on student learning. Therefore, any improvement effort to the environment will definitely help enhance student achievement. So called "good" learning environment (see Footnote 5) consists of four main factors: visual, acoustical, aesthetic and thermal environments. The visual environment refers to appropriate lighting system in the classroom to facilitate students in focusing their tasks. The acoustical environment means a well designed

environment free from external noise disturbance. The aesthetic environment focuses on an appropriate use of pastel color (see Footnote 6) to accommodate student learning activities. The thermal environment includes adequate air conditioning, heating and air ventilation in the classrooms to ensure physical comfort. As a matter of fact, the difference between new and old school buildings is whether attention has been paid in the application of these four basic factors. Facility experts believe that students achieve higher in newer school facilities with adequate visual, acoustical, aesthetic and thermal environments.

Seven studies have been conducted on the relationship of school building age and student achievement. They are briefly introduced in the following:

(1) Thomas (1962) studied the relationship of student achievement and over thirty variables including school building age. In a sample of 206 secondary schools, he found significant relationship between school building age and student achievement.

(2) Burkhead, Fox and Holland (1967) investigated the relationship of school building age and student achievement in 138 secondary schools. Results indicated significant relationship between school building age and student reading ability.

(3) In 1970, Michelson attempted to investigate 32 student achievement related variables in 597 white and 458 black students. He found significant relationship between age of school building and verbal scores of black students in the sixth grade.

(4) Guthrie, Kleindorfer, Levin and Stout (1972) believed that school building was an essential educational resource impacting on student achievement. In the study of over 50 students, they found significant relationship between school building age and reading ability, mathematics analyses, and verbal ability.

(5) School building age as an independent study was pioneered by C. W. McGuffey. McGuffey and Brown (1978) studied school buildings in over 180 school systems in Georgia. Results showed significant variance in student achievement attributable to school building age.

(6) Plumley (1978) focused his study on the elementary school buildings in Georgia. His study found five per cent of the variance in student achievement attributable to school building age.

(7) In a study involving 189 Georgia middle school buildings, Chan (1979) investigated the relationship of school building age and student achievement. Results indicated only one per cent of the variance in student achievement attributable to school building age.

In view of the seven studies cited above, there is no doubt that relationship exists between school building age and student achievement. However, the findings of these studies varied to a great extent by grade and discipline. Therefore, it is inappropriate to draw any conclusion on the research topic without sufficient evidence at this time. After all, each of the studies has its own weakness in technical design and data analysis (see Footnote 7). Future studies need to emphasize on research design to strengthen control over the variables affecting student achievement. Experimental design might be worth trying with a purpose of further assessing the relationship between student achievement and school building age.

(From: Ming Pao Monthly, Hong Kong, June, 1980.)

Footnotes:

(1) Old school buildings gain new life through major renovation which actually upgrades the quality of the facilities.

(2) When a school construction project runs into funding problem, a common practice to handle the finance without dropping the project is to lay out the entire project by phases. It might

end up costing more to complete the entire project but construction by phase helps release a timely financial pressure.

(3) School building age in many research studies has been used as an indication of the quality of facilities inside the building. Older school buildings are associated with obsolete facilities and newer school buildings contain more modern facilities. Some older facilities have been frequently upgraded to modern standard and the school building age will be adjusted accordingly.

(4) This is the same as the saying: "We shape the building in construction. Once we move in, the building begins to shape us."

(5) It takes a great deal of thinking and planning to create a "good" learning environment. Besides the four basic environmental factors, size, location, spatial relationship are among some of the other important considerations.

(6) The use of color in classrooms has been examined in several studies. Pastel colors stimulate thinking. Green and blue are more peaceful colors while red and orange colors tend to provoke actions.

(7) Out of the seven studies, only three studies concentrated on examining school building age as the major independent variable. The other studies only involved school building age as one of the many variables to see how it relates to student achievement. All the studies so far have been conducted at the school system level and the building level. Individual achievement and its relationship with building age has not been examined. Besides, in research design, studies so far have been ex post facto. Studies on an experimental type are strongly encouraged.

School Design and Instructional Need

A school building is a facility to accommodate instructional activities. Therefore, to fulfill its supportive function, the design of a school building needs to reflect the instructional needs of the school program. In recent years, as a result of educational program updates, many innovations have been made to instructional approaches and methodologies. Many school buildings become obsolete because of their failure to meet the requirements of the new instructional programs.

The traditional instructional setting was based on lecturing and question-answer types of activities in the classroom. Student interactions, often considered by traditionalists as disruptions to classroom order, were not encouraged. Even the furniture layout of the old classroom setting was designed in such a way that the students were made to face the instructor so that the students could pay him/her the best attention. However, in modern instructional approach, besides classroom lecturing, student feedbacks and interactions are very much favored. This is very often achieved by group activities in which students acquire a greater understanding of a problem through an exchange of ideas. To accommodate group activities, the instructional space needs to be large enough to allow furniture arrangement in groups.

The effect of instructional innovations on school facility design can be seen in the example of interdiscipline teaching (see Footnote 1) which is gaining popularity in schools. By interdiscipline teaching, teachers of different disciplines work together to arrange educational activities for a group of students. In an instructional unit, each teacher presents the aspect of the unit relating to his/her own discipline area. As a result, students are able

to better understand interdiscipline relationship in the same unit across the board. In the facility planning point of view, the accommodation of interdiscipline teaching activities requires larger classroom spaces with operable walls in between. Furthermore, teacher planning rooms must be designed in the adjacent areas to support instructional activities.

Additionally, the continuous expansion of educational programs causes corresponding changes in school facilities. This is very well exemplified in the expansion of special education program to address the educational needs of the handicapped children. By law, schools are required to make educational programs accessible to all handicapped children. Consequently, handicapped accessibility guidelines were developed to modify school facilities to meet the handicapped codes (see Footnote 2). Accordingly, special rooms in a school building need to be assigned and modified to serve particular categories of handicapped situations. In addition, restroom modification, curb-cutting, ramp installation, acoustical control, rails, elevators, and special safety lights are among the most common items for inclusion in the facility improvement projects to accommodate the special education program.

Besides those mentioned above, other educational elements impacting on school facilities include: school enrollment, grade classification, space utilization, instructional equipment, extracurricular activities and management system changes. When changes are made to these educational elements, appropriate modification to the school facility is needed. An educational program could only be successful if appropriate school facility exists to meet the instructional needs.

(From: Ming Pao Daily News, Hong Kong, October 30, 1982.)

Footnotes:

1. Interdiscipline teaching quoted as an instructional methodology in this article was gaining

    popularity in the late seventies and the early eighties. The physical requirement to

    facilitate interdiscipline teaching was brought to the attention of school facility planners

    of the time. Educators were aware of the extent of modification to the existing facilities

    to make it work.

2. When the law was passed addressing the handicapped accessibility issue, school systems

    were confused as to what exactly they needed to act to meet the requirements of the law.

    This became a hot topic for discussion at that time. It was not until some time later that

    the school systems started to respond to the handicapped accessibility problem. As a

    matter of fact, most of the handicapped accessibility modifications to school buildings

    were actually made in the late seventies and the early eighties. After all, it took the school

    systems a long time before they were financially ready to do anything.

Learning Environment and Student Achievement

Learning environment has direct and indirect impacts on student achievement:

(1) Direct Impact.

A good learning environment is associated with pastel coloring, appropriate lighting, controlled acoustics and proper air ventilation (see Footnote 1). A good learning environment frees students from physical distress, makes it easy for students to concentrate on school work and induces students in logical thinking. Students in good learning environment undoubtedly attain higher achievement. On the other hand, a poor learning environment is usually dull in coloring, inadequate in lighting, noisy in the surroundings and insufficient in air ventilation. Students in poor learning environment are under many physical constraints. Only very few students with great determination and self-discipline can overcome all the difficulties created by such hazardous environments (see Footnote 2).

(2) Indirect Impact.

Students are very sensitive to their learning environments. They respond to good and poor learning environments by expressing positive and negative attitudes respectively. With a positive attitude towards their learning environment, students learn with high motivation and undoubtedly are able to demonstrate better performance. On the other hand, students' dissatisfaction with poor learning environments will lead to lowering their interest and enthusiasm in learning. Consequently, poor student performance as a result of poor learning environment is no surprise.

To investigate the impact of learning environment on student achievement, the author initiated a field study in Georgia just recently. Involved in the study were one hundred and sixty-five Georgia

schools classified into one of the following environmental categories: (1) Modern Learning Environment, (2) Obsolete Learning Environment, and (3) Half Modern Learning Environment. The main differences among these three categories of learning environments are in coloring, lighting, acoustical control and air ventilation. Category (1) Environment and Category (2) Environment represent the two extremes of good and poor learning environments whereas Category (3) stands for a medium learning environment between Categories (1) and (2) (see Footnote 3). Student achievement data were also collected by school and were analyzed statistically by using Analysis of Covariance (see Footnote 4). Results indicated that students achieved the highest in Modern Learning Environment and the lowest in Obsolete Learning Environment. Student achievement in Half-modern Learning Environment was right in between Modern Learning Environment and Obsolete Learning Environment. The findings of this study is clear. It provides good evidence of environmental impact on student achievement.

In the first few decades of this century, actions taken to address the learning environment issues were slow. Effort of improving learning environment became more and more active in the recent fifty years. Before this time, many people still believed that physical discomforts in learning could be overcome by strong determination and keen learning desire. However, the fact is that only few students could still perform well under poor learning environment. Unquestionably, learning environment has an impact on learning activities. With all the high technologies of modern times, improving the learning environment by controlling the major environmental factors is not a problem at all. There is a need to improve students' learning environment to meet the physical needs of learning activities. Disregarding the improvement of learning environment is totally ignoring the physical difficulties of learning.

In recent years, with a better understanding of the environmental impact on the learning process, scholars began to develop their knowledge by verifying their experiences on the site. In some of the recently completed school buildings, the planners' intent to improve learning environment is obvious. Not only was attention drawn to lighting, acoustics and ventilation appropriateness, much effort was also concentrated on achieving an overall design effect to meet the educational needs of the students. This is a significant trend of development because a good learning environment results in higher student achievement.

(From: Ming Pao Daily News, Hong Kong, June 30, 1980)

Footnotes:

(1) Coloring, lighting, acoustics and air ventilation are the four main environmental factors affecting student learning. It has been evidenced in many previous studies that pastel coloring enlightens thinking, appropriate lighting delays visual fatigue, controlled acoustics helps mental concentration and proper air ventilation enhances physical comfort.

(2) Good learning environment is not an absolute factor that impacts on student achievement. Some students can overcome all the physical discomforts and still perform excellently in poor learning environments. However, when poor learning environment is a known factor to hinder learning, educators have no reason not to create an inducive environment to help students learn.

(3) Four physical conditions were established in the study: (a) pastel coloring, (b) carpeting as acoustical control, (c) fluorescent as appropriate lighting and (d) air-conditioning as adequate ventilation. The following qualifications were displayed in classifying schools into categories of learning environments: (i) Modern Learning Environment-----all four conditions must be

met; (ii) Obsolete Learning Environment-----none or only one of the conditions was met;

(iii) Half Modern Learning Environment-----any two of the four conditions must be met.

(4) Socioeconomic status of students' families (SES) was also involved in this study as a covariate

to control the effect of SES on student achievement.

My View on Learning Environment

----A Rejoinder

In an article entitled "Learning Environment and Student Achievement" published earlier in Ming Pao Daily News (see Footnote 1), the author analyzed the direct and indirect relationship between learning environment and student achievement. In the same article, research findings were cited as evidence to confirm the impact learning environment had on student achievement (see Footnote 2). A friend of the author who had different viewpoints stated that nicely designed learning environment allowed too much comfort for students who could easily lose their learning desire in leisure (see Footnote 3).

Disagreeing with his friend, the author would like to bring up a few points about learning environment for further discussion:

First, learning environment, as previously discussed, refers to the physical environment in which students learn. It consists of all the classrooms and set-up for learning activities in a school facility. Therefore, any effort to improve the learning environment is interpreted as an attempt to enhance the quality of the school building.

Second, research reported that the variance in student achievement attributable to learning environment was small (see Footnote 4). However, the variance indicates a positive impact of learning environment on student achievement. For years, educators have been seeking to reveal controllable factors accounting for student achievement. Since learning environment has been identified as one of those factors affecting student learning, there is no reason not to pursue any further in the improvement of learning environment.

Third, educational innovations and technology development add new dimensions to enhance the student learning process. The implementation of these educational endeavors is usually accompanied by physical changes in a school building. (see Footnote 5).

Fourth, the author previously suggested improvement to lighting, air ventilation, acoustical control and coloring as basic considerations to enhance the quality of the learning environment. These improvements should not be mistaken for luxuries because every effort points at eventually enhancing student learning.

Finally, the author simply cannot understand why a student must be placed in a dilapidated learning environment to be a motivated learner. In fact, a dilapidated environment is a physical hindrance to student learning. A well designed learning environment takes into consideration the essentials of the learning process and the latest technological development. Students under well designed environment increase their physical comfort and decrease their mental distress. The result is that students are more concentrated in their work and complete their tasks with great confidence. (From: Ming Pao Daily News, Hong Kong, October 18, 1980.)

Footnotes:

(1) "Learning Environment and Student Achievement" was published in Ming Pao Daily News, on June 3, 1980, Page 6.

(2) The author cited his own research findings in the State of Georgia as evidence of the relationship of learning environment and student achievement. (see the article on Page 7 of this manuscript.)

(3) "Students losing their learning desire in comfortable environment" does not have a strong hold in argument. It was based on the belief that a student could overcome physical difficulties created by poor learning environment if only he/she could exercise his/her mental concentration

and strong determination. However, the argument fails to examine the basic physical needs of human beings in a man-made environment.

(4) The variance in student achievement attributable to learning environment has been found to be from one to five per cent except in Donald Garrett's research in which twelve per cent was reported.

(5) In school facility planning, this is a reinforcement of the saying that "Function dictates the form".

Three Studies on School Facilities

During his years with the University of Georgia, the author had a great opportunity to study with Dr. J. P. Plumley and Dr. D. M. Garrett under the direction of Dr. C. W. McGuffey (see Footnote 1). A common interest in researching the relationship of school facilities and student achievement was generated. Dr. Plumley's and the author's studies were the first to be completed and published. Having heard that Dr. Garrett has recently completed his study, the author thought this would be a good time to introduce all three studies to our readers at the same time (see Footnote 2).

Plumley's research involved all the elementary schools in the State of Georgia. He collected data on school building quality and student achievement. With the use of analysis of variance, he found that approximately five percent of the student achievement variance was attributed to school building quality.

The author's study focused on the middle school level investigating the relationship between school building quality and student achievement. Data collected were systematically analyzed by using Pearson's correlation and analysis of covariance. Results indicated that only one percent of the student achievement variance was attributed to school building quality.

Garrett took advantage of his position as high school principal and focused his research interest in the high school level. His research methodologies were very similar to the other two. However, the results of his study yielded a twelve percent student achievement variance attributable to school building quality, a percentage higher than those found by the other two studies.

The value of these three studies is to bring about additional evidence to support the postulate that student performance is influenced by the physical learning environment. However, some critiques

have made the point that the geographic location of these studies made it difficult for someone to draw a universal generalization. The author disagree with this argument because the nature of the problem is universal and people in other parts of the United States and the world have also come up with similar findings in their studies. The findings of our three studies are only part of the overwhelming evidence in this research field.

Furthermore, the findings of these three studies could also be analyzed on a comparative basis. Since the backgrounds and approaches of these three studies were on the same track, any valid differences among these studies could easily be observable. Garrett's study have indicated a twelve percent variance in student achievement attributable to school facility quality. This high percentage of variance, as compared to the other two studies, suggests a greater impact of school facilities on student achievement in the high school level. In addition to statistical analysis, the significance of high school facilities can also be examined by logical reasoning. Because the high school program is more complicated than those of the elementary and middle schools, more sophisticated facilities are needed to support the high school program . This more demand of facility requirement in high school is an indication of the close relationship between school facilities and student performance (see Footnote 3).

(From: Ming Pao Daily News, Hong Kong, March 12, 1983.)

Footnotes:

(1) Dr. C. W. McGuffey started investigating the relationship of school building age and student achievement in 1976. His study was performed at the school system level. Since then, he had been looking for other researchers to continue the study in the school building level. Dr.

Plumley, Dr. Garrett and the author just fitted in his research project. Dr. McGuffey considered research at the school building level a more refined approach than at the school system level.

2) The topic of our studies is "The Impact of School Building Age on Student Achievement". School building age, the independent variable, was used as an indicator of the quality of school facilities in the studies. School building age was determined by the year of original construction. Whenever a major renovation occurred, the school building age was updated by using the year of major renovation. Therefore, our studies were actually looking at the relationship of school facility quality and student achievement. Plumley's study was completed in 1978, the author's in 1979 and Garrett's in 1982.

(3) Because of the nature of its program, a high school needs a great deal more special equipment and facilities to support its daily instructional needs. In other words, high school students depend more on school facilities to assist them in their school work than students of other levels. This was one of the major findings in Garrett's research.

Environmental Psychology and Facility Planning
(see Footnote 1)

Physical environment has an impact on human behavior, thinking, feeling and attitude. The study of how human behavior, thinking, feeling and attitude change under different physical environments is known as Environmental Psychology.

The relationship of man and his living environment came to the attention of researchers long time ago. But there was no effort of organized academic study as such until the turn of the century. It has become very evident since the Second World War that architects have designed buildings not only with intended users in mind but also with feedbacks from users of previously designed buildings. Designers understand that users know best what works and what does not (see Footnote 2). The follow up procedure of seeking feedbacks has helped many designers to better understand the efficiency of their design products.

On the other hand, because of the emergence of new design ideas and improved technologies, the physical environment of new facilities is different from that of the old ones . New facilities will significantly change the users' behavior, thinking, feeling and attitude towards their daily tasks. The environmental psychologists are interested in the background, the concepts and the process of new facility planning ideas as well as their magnitude, pattern and impact on facility users.

The study of environmental psychology in relation to facility planning is focused on the following issues:

1. Symbolism ----- The design of a facility is a complex process. The design considerations range from space inclusion to illumination, coloring, equipment selection and decoration, just to name a few. In making decisions in designing, the designers always examine if certain design options truly

reflect the message the facility owner intends to deliver. The designed product in the facility will serve as a symbol of the owner's message.

2. Space Utilization ----- One of the most important component of facility planning is the design of adequate spaces. This is very much dependent on how the spaces in the facility will be utilized. The environmental psychologists are concerned with the way the facility users feel about the spatial concepts, such as space openness, balance and relationship. Results from the environmental psychologists' research will certainly provide useful information for facility planners' reference.

3. Territoriality ----- The environmental psychologists are interested in studying how territoriality impacts individual performance. It is anticipated that space occupants behave more positively in a territory they can claim their own. Research in territoriality provides facility planners with valuable information in making decisions on spatial distributions (see Footnote 3).

4. Individualism ----- Because of individual differences, certain people may find particular environments more comfortable to them than others. Therefore, it is impossible to design a facility to suit everybody's needs. In designing a building, facility planners will need to consider the demographics and characteristics of the future facility users. Environmental psychologists and facility planners are both concerned with the influence a designed environment has on the facility users with much individual differences.

5. Cultural Differences ----- Cultural differences exist in race, socioeconomic status, age, gender and education level. The environmental psychologists are interested to find out how facility users from different cultural backgrounds will react to a pre-established environment. On the other hand, facility planners are interested in how to design an environment which will be inviting to future users from different cultures.

In conclusion, environmental psychology emerges as a popular area of academic study relating to both the physical environment and human psychology. It provides facility planners with resourceful references for the design of meaningful architecture (see footnote 4).

(From: Ming Pao Daily News, Hong Kong, March 6, 1981.)

Footnotes:

(1) The original title of this article is "Introducing Environmental Psychology". However, in view of this article, the author is convinced that " Environmental Psychology and Facility Planning" is a more appropriate title to this article in terms of its contents and references.

(2) After a school building is occupied, regular visits are usually scheduled for school business officials to get feedbacks from the users. All comments will be delivered to the original designers for references. Architects and engineers do visit a new school building from time to time to resolve problems that may occur in the first year of building operation. An official walk through is usually scheduled to inspect the school building before the one year warranty ends.

(3) Facility planners are interested in knowing how many people will be using the facility at various times, what kinds of space they should design to fit the need and what degree of openness should be designed in these spaces. These are questions a territorial study can answer.

(4) Environmental psychology and facility planning share many common grounds. While environmental psychologists are interested in investigating how individuals react in different environments, facility planners will use the research findings to plan facilities. Research studies by environmental psychologists are very often cited by facility planners as evidence to support their design decisions. In some environmental issues, when little research was performed by environmental psychologists, facility planners very often go in to pick up the investigation.

Educational Facility Research in America

Learning environment has always been considered as part of man's living environment. However, the investigation on man's living condition had started a long time ago before any attention was paid to the learning environment of school children. It was not until the early twentieth century that Americans began their systematic and scientific research on the physical aspect of educational environment covering all the equipment and facilities that serve to support education.

The rise of educational facility research is attributed to several factors: First, research on educational facility helps to resolve questions about how educational environment impacts the teaching and learning behaviors of human beings. Second, educational facility research provides a basis on which decisions on energy conservation, building utilization and building efficiency can be made. Third, educational facility research reveals the obsolete conditions of school buildings due to educational program updates. Fourth, educational facility research supports a master planning effort to accommodate the fluctuation of school population.

Since the 1930's, the effort of the educational facility researchers has been verified by the continuous improvement of school environments. Some of the earlier research were relating to lighting and air ventilation of school buildings. Research methodologies were very simple. Later on, the scope of research was extended to many areas among which open space, space utilization, energy conservation and cost efficiency have been the more popular topics (see Footnote 1). In research design, most of the earlier research were descriptive in nature. In recent years, research design in educational facilities has been well refined to include experimental and ex post facto types. The research effort has been much facilitated by the use of statistics and computer network.

At present, many scholars are involved in the research of educational facilities, generating a considerable amount of research projects. However, the research effort has been dispersed without much coordination. Professional organizations involved in educational facility

planning include the Council for Educational Facility Planning, American Association of School Administrators, Association of School Business Officials, Illumination Engineering Society, American Institute of Architects and Educational Facility Laboratory, In addition, all research based universities in the United States are taking an active role in promoting facility research activities (see Footnote 2).

Nevertheless, independent research effort without any central coordinating agency is still the greatest barrier to research development in educational facilities. In regard to that, Dr. Carroll W. McGuffey of the University of Georgia proposed organizing an educational facility research consortium to systematically coordinate all research activities in educational facilities. One of the goals of the proposed effort is to establish a computerized facility database to enhance research activities. It is also anticipated that the consortium will assume a leadership role in directing the trend of research effort towards improving the learning environment of school children (see Footnote 3).

(From: Ming Pao Daily News, Hong Kong, July 3, 1984.)

Footnotes:

1. The scope of research in educational facility enlarges as a result of educational innovations, new design ideas and concerns about school buildings. Asbestos in building materials, lead contents in drinking water, environmental contamination and electronic technologies are some of the most recent focus of educational facility concerns. This continuous discovery of new topics adds new dimensions to the research program of educational facilities.

2. Most of the educational facility research projects in the higher education level are administered by scholars in the Department of Educational Leadership and Department

of Architecture. Some universities are able to secure particular funding to establish educational facility laboratories to support research activities.

3. Up to the present time, no such central organization has yet been established to play such a leadership role as envisioned by Dr. C. W. McGuffey. However, in the past ten years, research effort in educational facility has been most active. First, the Council of Educational Facility Planners has expanded its scope of activity involvement worldwide. The School Facility Committee of the Association of School Business Officials has been very active internationally. Members of the American Institute of Architecture have also taken special interest in the research of educational buildings. These professional organizations have developed their own database to manage educational facility information. Modern technology has facilitated the accessibility of research data through communication networking. The Educational Research Information Center funded by the United States Government continues to serve as a center for the dissemination of school facility research documents.

References

Burkhead, J., Fox, T. F. & Holland, J. W. (1967). Input and output in large city high schools. Syracuse, New York: University Press.

Burnette, E. (1962). Influence of classroom environment on word learning of retardates with high and average activity levels. Unpublished doctoral dissertation, George Peabody College for Teachers.

Chan, T. C. (1979). The impact of school building age on the achievement of eighth grade pupils from the public schools in the State of Georgia. Doctoral dissertation, University of Georgia.

Chorlton, J. M., & Davidson, H. F. (1959). The effect of specular reflection on visibility: Part II - Field measurements of loss of contrast. Illuminating Engineering, 8, 482-488.

Conrad, M. J., & Gibbons, N. L. (1963). Carpeting and learning. Columbus, Ohio: The Ohio State University.

Dixon, M. T. (1953). Comparing acoustical control and the efficiency of verbal communications. Unpublished doctoral dissertation, Stanford University.

Garrett, D. M. (1982). The relationship of school building age and the academic performance of high school students in the State of Georgia. Unpublished doctoral dissertation, University of Georgia.

Getzels, J. W. (1975). Images of the classroom and visions of the learner. In T. G. David & B. D. Wright, (Eds.), Learning environments. Chicago, IL: University of Chicago Press.

Guth, S. K. (1951). Comfortable brightness relationships for critical and casual seeing. Illuminating Engineering, 2, 65-73.

Guthrie, J. W., Kleindorfer, G. B. , Levin, H. M., & Stout, R. T. (1971). School and
Inequality. Cambridge, Mass.: M.I.T. press.

Helson, H. (1965). A review of activities during the year with emphasis on the relationship
between colors and lighting. Illuminating Engineering Institute Annual Report.

Jentges, J. E. (1956). An experimental study of the acoustical efficiency in classroom
environments. Unpublished doctoral dissertation, Stanford University.

Ketcham, E. (1964). Those colors fit your school decor. Nation's Schools, 74(5), 61.

Lovin, J. C., Jr. (1972). The effect of school's physical environment on the self-concepts of
elementary school students. Unpublished doctoral dissertation, University of Georgia.

Manning, W. R. , & Olsen, L. R. (1964). Air-conditioning: Keystone of optimal thermal
environment. American School Board Journal, 149(2), 22-23.

McCardle, E. G. (1966). Thermal environment and learning. Unpublished doctoral
dissertation, University of Iowa.

McDonald, E. G. (1960). Effect of school environment on teacher and student performance.
Air-conditioning, Heating, & Ventilation, 57, 78-79.

McGuffey, C. W. & Brown, C. L. (1978). The impact of school building age on school
achievement in Georgia. CEFP Journal, 16(1), 6-9.

Michelson, S. (1970). The association of teacher resourcefulness with children's
characteristics. In How Do Teachers Make A Difference? U.S. Department of Health,
Education, and Welfare, Office of Education. (OE-58042), 120-168.

Peccolo, M. (1962). The effect of thermal environment on learning. Unpublished doctoral
dissertation, Iowa State University.

Plumley, J. P., Jr. (1978). The impact of school building age on the academic achievement of pupils from selected schools in the State of Georgia. Unpublished doctoral dissertation, University of Georgia.

Proshansky, H. M. (1975). Theoretical issues in environmental psychology. In T. G. David & B. D. Wright, (Eds.), Learning environments. Chicago, IL: University of Chicago Press.

Rice, A. H. (1953). Color: What research knows about the classroom. Nation's Schools, 52(5), 1-8.

Sampson, F. K. (1970). Contrast rendition in school lighting. New York, NY: Educational Facilities Laboratories.

Thomas, A. (1962). Efficiency in education: A study of the relationships between selected inputs and mean test scores in a sample of senior high schools. Unpublished doctoral dissertation, Stanford University.

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