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Educational Facilities: The Impact and Role of the Physical Environment of the School on Teaching, Learning and Educational Outcomes

Jeffrey A. Lackney

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ABSTRACT

It is often argued that the quality of the educational environment is rapidly diminishing due to the plethora of social and economic problems plaguing urban communities. As a result of the present crisis, the physical infrastructure of the school system has been virtually ignored. To what degree has this frail physical infrastructure affected education over the past ten years and, what is the impact and role of the school building in achieving the performance outcome-based goals of educational reform? This document reviews the body of evidence over the past twenty-five years in an attempt to address this question. The physical setting of the school is reconceptualized as an integral part of the total educational environment. The author synthesizes existing models and frameworks developed within educational, environmental psychology and architectural literatures in an effort to develop one conceptual framework that would direct further applied research on educational environments.
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RELATED PUBLICATIONS

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PREFACE AND ACKNOWLEDGEMENTS

"They're always talking about 'we're the future of America,' and they won't even give us a decent place to learn"
a junior high school student in Alabama

In 1993, school districts across the U.S. completed a record $10.79 billion in total construction, with $4.6 billion (42.5%) being new construction.[1] *Yet, ironically the existing infrastructure of urban schools continues to deteriorate. As a result of the present crisis in the educational quality of American schools, resources have been generally diverted to educational reform measures at the expense of the physical infrastructure of the school system. In short, the deteriorating state of urban school facilities have been virtually ignored by the public and educational policymakers alike.*

It is my contention that facilities are having a detrimental effect on the education of children in urban areas. For instance, the American Association of School Administrators recently published a summary report which claims that "nearly 5 million children are subjected to substandard schools every day[2]*. A recent study by Mareen Edwards claims that educational building conditions, such as deferred repair and renovation, in the Washington, D.C. area are influencing student performance estimating that improved facilities could lead to a 5.5% to 11% improvement on standardized tests*[3]*.*

Public recognition that school buildings in many communities across the nation are in poor condition is growing. Currently, many school districts across the country are in the planning stages of a massive upgrading of the facility infrastructure. Demographic projections indicate a continued increase in K-12 populations over the next 10 years. Despite the urgency, there is no consensus among the taxpaying public, state departments of public instruction, or local school districts as to what constitutes the real needs of schools and how best to address these needs once they are identified. In addition, there is little agreement among teachers, administrators, public officials or the public at large regarding the significance of these statistics, or whether school buildings even impact educational performance in any substantial way.

This document addresses the issue of the impact and role of the school building on the educational process. Further, it synthesizes and builds upon existing models and frameworks developed within educational, environmental psychology and architectural literatures in an effort to develop one conceptual framework that would direct further applied research on educational environments.

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[1] Abramson, P. (1994). Still Growing. *American School & University, May*, 35-44.

[2] AASA (1992). *Schoolhouse in the red: A guidebook for cutting our losses*. American Association of School Administrators.

[3] Edwards, M. (1991). Building conditions, parental involvement, and student achievement in the DC Public School System. Unpublished master's thesis, Georgetown University, Washington, D.C.

The body of this work attempts to achieve three main goals: first, to establish an agenda for future research on school environments by identifying areas which have not been empirically studied; second, to provide architects and educators with a explicit list of key concepts which have the most justification for consideration; and finally, to increase awareness within the educational community and the wider national audience of the neglected role of the physical environment of the school of the process of education.

Chapter 1 provides an introduction to the scope of the problem of a deteriorating school infrastructure in the United States. Chapter 2 offers a case study of the Milwaukee Public Schools Facility Master Plan as a illustrative example of the societal context within which these issues are often resolved (or ignored). Chapters 3 and 4 provide the substantive body of the document reviewing the literature in detail. Two distinct reviews of the literature on educational environments are developed: the first from an analytic perspective (Chapter 3), and the second from an integrative perspective(Chapter 4). Chapter 5 addresses the process of developing and managing school facilities, critiquing and reconceptualizing the current educational facility planning model. Chapter 6, acting as the concluding chapter of the document, synthesizes and builds upon existing models and frameworks developed within the educational, environmental psychology and architectural literature in an effort to develop one conceptual framework -- a Multidimensional Model of Educational Environments -- from which to direct further research on educational environments. Finally, an annotated bibliography is provided in the Appendix.

This publication represents a collection of working papers by the author. As a result, the reader will experience some subject overlap between chapters. In addition, references are intentionally retained at the end of each chapter to facilitate further study and investigation.

I would like to acknowledge the following individuals who have offered their insights on my on-going work: Gerald Weisman, Harvey Rabinowitz, James Cibulka, Gary Moore and especially Jill Dittrich. The conceptual model developed in the final chapter is but the latest in a series of versions inspired by numerous Thursday night debates with my colleagues Herb Childress and Maggie Calkins. Finally, I would also like to acknowledge the support of the Johnson Controls Institute of Environmental Quality in Architecture and its director Larry Witzling.

Jeffery A. Lackney
July 15, 1994

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INTRODUCTION TO THE PROBLEM

"...the point is that all the school reforms on earth are worthless if kids have to come to school in buildings that destroy their spirits."
Johnathan Kozol, *Savage Inequalities* (1991)

1.1 THE STATE OF PUBLIC EDUCATION IN THE U.S.

There is a crisis in America's public educational system that can best be described as a quagmire of conflicting socio-economic, political, bureaucratic and cultural problems and issues. The crisis has reached its highest proportions in the major urban centers of the U.S. Kozol (1967) was one of the first to critique the conditions of urban schools in his book *Death at an Early Age*, and continues to argue for the continuing deterioration of urban schools more than two decades later in his book *Savage Inequalities: Children in American Schools* , published in 1991.

There are numerous reasons cited for the current crisis in U.S. schools in general, and urban schools in particular:

- Conflicting *societal influences* -- national and local politics and ideology, public opinion and the litigious legal climate (desegregation, teacher unions, etc);
- Deteriorization of the *socio-economic conditions* which have plagued inner-city communities for decades -- loss of jobs, middle class flight from the central city, crime and violence, drug and alcohol addictions, poverty, hunger, homelessness, the AIDS epidemic, teenage pregnacy, single parent households and child abuse (Wilson, 1987);
- Internal *public schooling debates and issues* -- gridlocked educational policymaking, bureaucratic structure and governace of urban school boards (Borman & Spring, 1984), school organization, tracking and ability grouping, drop-outs, testing procedures, and in-service training for the management of multi-cultural classrooms.

Bringing the crisis full circle is the ever-present ideological dimensions of schooling -- bringing the inequities of society such as class, race, gender and ethnicity directly into the classroom setting (Kretovics & Nussel, 1994).

In response to these pressing problems, and fueled by the domestic recession and international economic crisis and escalating competition of the early 1980s, a new round of educational reform debates ensued. Poorly performing schools were blamed for the failing economy and the U.S. loss of competitiveness abroad, a recurring theme in the history of public schooling in the U.S. (DeYoung, 1989).

There have been numerous calls for educational reform at the national level, starting in 1983 with the release of "A Nation at Risk" report. The Bush Administration's Break the Mold Schools Program, and The New American Schools Development Corporation (NASDC), which have advocated reforms such as extending the school

day and the school year, school choice programs and voucher systems (Chubb & Moe, 1991). The so-called privatization of the public schools (school adoptions, institutionalized partnerships and collaborations, and business-supported programs for children at risk) include projects such as Whittle Communications Edison Project, EAI's Alliance for Schools That Work, Coca-Cola Foundation's Valued Youth Program, Chevron and Ford's Project 2000. These projects call for increased curriculum and testing standardization, outcomes-based education such as portfolios and other new forms of assessment (Wiggins, 1993), as well as rhetorical calls to totally "restructure", "re-engineer" and "continuously improve" the educational system.

A recent 1993 report from American business leaders assessing the educational reform movement, "Ten Years After A Nation at Risk" (cited in Walsh, 1993), concluded that schools have made little progress towards the goal of improved quality of education. Business leaders are not the only group who are dissatisfied by the results of educational reform: educational leaders, teacher unions and the public-at-large are not convinced that reforms have or will make a difference. Compounding the consensus on reform failure is the continued lack of willingness on the part of school organizations to embrace and respond to change (Sizer, 1991; Sarason, 1971).

1.2 THE STATE OF PUBLIC SCHOOL INFRASTRUCTURE

As a result of the present crisis in American schools, resources have been generally diverted to educational reform measures at the expense of the physical infrastructure of the school system. In short, the deteriorating state of school facilities have been virtually ignored by the public and educational policymakers alike.

In 1989, the Education Writers' Association released a study of the condition of school buildings which found that 49% of all schools nationwide were built in the 1950 and 1960s primarily to meet the increasing demand for schools for baby-boom children (as reported by Walker, 1993); infering that approximately 41,000 public school buildings will need major renovation or refurbishing between 1995 and 2000 (Goldberg & Bee, 1991). Many of these buildings were constructed of cheaper building materials, flat roofs, and built to last no more than 20 years without some form of major repair. In addition, these buildings, although often claimed by their designers to provide flexible space, have not met this standard. The study also found that 21% of buildings nationally are more than 50 years old and are located primarily in the inner-cities. These buildings have been especially neglected and are in need of major repair and renovation due to short-sighted maintenance and repair policies. The most alarming finding of the study was the fact that over 25% of the buildings were considered inadequate for educational use by state facility directors as a result of serious maintenance and repair needs, environmental hazards, and overcrowding, and another 33% of these buildings will be at capacity due to population growth and other educational demands in the near future.

Solutions proposed to overhaul the educational system disregard and in some cases completely abandon the pressing day-to-day operational needs and physical comfort of teachers and students, forcing them to implement educational reforms in dilapidated, over or underheated, environmentally toxic, poorly furnished, unsupplied classrooms.

Examples of physical deterioration can be found in many schools across the U.S.:

- In New York, at Boys High in Bedford-Stuyvesant district of Brooklyn, paint is peeling, toilet stalls lack doors, and due to drinking fountains spouting rust, teachers dole out water from insulated jugs in the classrooms (Jackson, 1993).

- In Alabama's Choctaw County, where eight rural schools were built in the 1930s, the window sashes are so frail that the panes pop out in high winds or bad weather, and sewage overflows within the buildings (Jackson, 1993).

- In Chicago, at Caldwell School, students have had to put up with rain and wind seeping through most of the 192 windows at the facility for the past ten years, and shoddy repair work has left many windows permanently closed by plastic and plywood. Because of complaints of cold, building heat has been turned up so high that other parts of the building swelter to as much as 86 degrees. (Ortiz, 1993).

- In Milwaukee, 73 of the 110 school buildings in the District were built before WWII and a large number are over 100 years old and in desperate need of repair and maintenance (Lawrence, 1993).

- The District of Columbia Commission on Public Education (1989) cited 11,000 fire code violations in 152 schools in the nation's capital alone. In addition, the study cited fire doors that don't work, classroom doors that don't close, broken toilets, crumbling plaster, potholed playgrounds and malfunctioning heating systems among other problems with the learning environment.

These are not isolated cases. Recently, a national poll of administrators found that 59% of 5,370 buildings surveyed were described as in poor to barely adequate condition (as reported by Jackson, 1993).

As Kozol (1991) has stated in his book *Savage Inequalities,* "the point is that all the school reforms on earth are worthless if kids have to come to school in buildings that destroy their spirits." Kozol and other social critics have expressed their belief that "the notion that the schoolroom is secondary to the schooling is used as an excuse for pushing the issue of crumbing buildings far down the education agenda" (Jackson, 1993; 6).

Issues Beyond Physical Deteriorization

In many ways, this physical deteriorization is symbolic of what is wrong with our educational system: a general lack of concern with the educational environment as a whole and an overreliance on reform rhetoric to solve the problems of urban schools. In fact, the physical deterioration of school buildings is only one aspect of what is ailing the facilities in which teaching and learning takes place.

Overcrowding Conditions

First, and most importantly, overcrowding conditions in existing schools due to a steady increase in population of school-aged children continues to be a problem for school districts around the country. The Educational Research Service recently reported an analysis of the latest Census Bureau statistics concluding that the estimated 45,630,000 school-age children in 1990 are projected to increase in number to a high of 49,011,000 in 1998, a 7.4 percent increase (as reported in Graves, 1993).

The population projections by ethnic group indicate that between 1990 and 2010, the school-age population of African-Americans, Hispanics, and other races will continue to grow faster than that of whites and with many in the urban centers of the U.S. (as reported in Wilson, 1989).

Links between Educational Program and School Design

Second, existing classroom layout and design created for earlier eras of instruction are not suitable to current instructional methods and educational philosophies. Some buildings are still organized for late 19th and early 20th century factory models of schooling in which classrooms are organized for 30-40 pupils in rows and columns along double loaded corridors.

During the 1960's in the U.S., challenges to traditional education forced a radical change in educational philosophy. Educational reform movements favored a teaching model along similar to the British informal education model; individualized, self-directed study. As a result, open education, and its complementary physical counterpart, the open classroom, were soon espoused (Barth, 1972; Kohl, 1969; Gross & Murphy, 1968). In terms of architectural interventions, the open space classroom was a milestone in the history of classroom design, replacing the conventional 'egg-crate' school plan. It has been reported that as many as fifty percent of all schools built between 1967 and 1970 were open space design (Weinstein, 1979).

In the 1980s and 1990s, the eariler egg-crate designs of the 1950s and the pod and cluster open classroom arrangements of the 1960s and 1970s fail to provide the most supportive and effective use of space required for today's reliance on new technology. For instance, open classrooms have been closing up gradually over the past twenty years due to problems concerning noise and privacy, while egg-crate classes continue to be unsupportive in implementing multiple instructional strategies such as individualized instruction and cooperative learning. New forms of classroom space configurations are only now being considered in relation to educational reforms, such as designs for small schools, small classrooms, portfolio studio arrangements and computer technologies (Genevro, 1990; California Department of Education, 1990; Moore & Lackney, 1993).

Facility management

Third, there is currently a lack of responsive facility management services to maintain and operate, update and modernize existing school buildings to adequately meet the needs of teachers and students. For example, abuses in the custodial system of the New York Public Schools have been linked to custodial neglect and the decrepit disrepair of schools in the district (Slater, 1992). In Chicago, a housing court judge resorted to appointing an outside consultant to do much needed window repair work to a South Side school when the Chicago Board of Education failed to deal with the ten year old problem (Ortiz, 1993).

The problem of poorly responsive facility management is primarily a result of deferred maintenance policies due to the lack of general operating funds. In most cases communities draw maintenance and repair funds from the state and local funding which makes up the majority of their budgets. Larger projects such as additions or new schools commonly come from bond offerings taken to voters. However, due to the shrinking community tax base, bond offerings are having more trouble being passed, and as a result more resources normally used for maintenance

are often used elsewhere. Reduced funding can be directly linked to reduced, underpaid support staff who are, in many cases, poorly trained.

A more fundamental problem however, may be that most facility management services are not functionally integrated with either educational policymaking or budgetary processes. Decisions are not made in ways which look comprehensively at a problem. Such is the case with the Milwaukee Public Schools (See Chapter 2). A building plan proposed in 1992 by the district's superintendent was resoundingly defeated by taxpayers who insisted that resources go first to boosting academic averages and increasing the number of teacher aides. The Superintendent argued that it would be much harder to improve the district's curricula and academic achievement without first addressing the district's infrastructure needs at the same time. The result is that unfortunately, very little has been done to date to adequately address either problem (Lawrence, 1993).

Teacher in-service training

Finally, there is a lack of in-service training of teachers in how to effectively utilize and maintain their classroom space to support their instructional efforts, and to date, there is no literature concerning this topic. What the scope of the problem may be, or how to develop strategies to inform teachers in the use of instructional space in unknown.

Design collaboration

An issue which receives much attention in construction trade and school administrator professional journals (see any issue of *American School and University* , *CEFPI Journal, School Business Affairs*, or *American School Board Journal*) is that of collaboration of school staff in the design of new school facilities. Unfortunately, the collaboration which takes place rarely includes the public or the occupants for which the schools are intended to support. When these individuals are involved the level of involvement is superficial at best (See Chapter 5). School staff are often not involved until more fundamental design decisions are resolved (such as site planning and building layout and configuration); limiting staff input to interior classroom design issues.

Current models of the educational facility process were originally developed during the dramatic educational system reforms of the 1960s in which state involvement in school finance and governance expanded to include the planning of facilities. Many educators believe that "state legislatures, regulatory agencies and product manufacturers have had more effect on school design and equipment than educators themselves"[4]. Contrary to recent rhetorical calls for participation by educators in the planning and design process, few educators have traditionally been involved in a process that has been consistently controlled by architects and by educational administrators and planners, both state and local.

Scope of the problem

The national scope of the problem of the ailing school infrastructure has been well documented. In 1990, the Educational Writers Association estimated that a total of $143 billion will be required to overhaul the nation's urban school buildings which number approximately 84,580 (reported by Jackson, 1993). Over 50% of schools in

[4]Harold Hawkins, The Interface Project, Texas A&M University, quoted in *Education Week*, February 21, 1990.

the US were built in the 1960s with a projected life of 35 years, meaning that over 42,000 school buildings will need major renovation or refurbishing between 1995 and 2000 (Goldberg & Bee, 1991). The New York City Public School system alone has reported the need for $24 billion in construction over the next decade to repair and upgrade the system's 1,053 school facilities (*Education Week, V12*: 16, January 13, 1993).

In comparison, school districts spent a total of $10.73 billion in 1992; $4.57 billion in new construction (which represents approximately 500 new school buildings), and $6.16 billion in additions and modernizations (Abramson, 1993). This figure represents a fraction (less than 5%) of the $220 billion spent on public education in 1992. It is clear from the amount of dollars being spent on new and existing schools that these numbers come far short of the need. Despite these well-documented statistics, there is little agreement among teachers, administrators, public officials, or the public at large regarding their significance, or even whether school buildings themselves play a fundamental role in educational outcomes to warrant attention.

Given the limited financial resources available for education, the question then becomes one of determinining the areas of the educational environment that should recieve funding. The answer is simply those areas which show the greatest substantial contribution to the improvement in the overall quality of the educational process. The decisionmaking process for resource allocation should include recognition of the facility itself. In many cases, the facility's value is either ignored or discarded at some phase in the decisionmaking process. It must be emphasized that the improvement of the educational environment should be intergral and comprehensive. Educational policymakers must evaluate all facets of education concurrently to achieve the greatest degree of success in the decisionmaking process.

1.3 THE IMPACT AND ROLE OF THE PHYSICAL SETTING ON LEARNING

To justify the expenditures to the physical infrastructure of public schools several related questions must be addressed: First, to what degree of effect has the reportedly deteriorating physical infrastructure had on education over the past decade? Secondly, what is the impact and role of the physical environment of the school in achieving the bottom-line academic achievement goals set by curreent educational reform?

The Effect of a Deteriorating Physical Infrastructure on Education

It is unclear whether the first question can be satisfactorily answered with any degree of certainty. Little empirical research has been conducted which addresses the effects of a deteriorating physical environment on the educational process. At most, anecdotal evidence is offered in media accounts of neglected classroom conditions in which teachers and students struggle with the elements. As a result, only negative reports of the physical environment are publicized and no explicit mention of their possible effects on schooling are offered. It is clear from media accounts and public opinion that negative images of the physical environment are seen as symbolically representing the neglect of the educational system in providing a quality education for children.

There are some reports which call attention to the environment's affect on learning. Edwards (1991) has claimed that building conditions harm student performance, and

estimates that improved facilities could lead to a 5.5% to 11% improvement on standardized tests. Johnson (1990) found that the school's physical environment influences the intentions of even the best teachers to continue in teaching. More generally, it has been suggested that students attitudes about education are a direct reflection of their learning environment (Carnegie Foundation, 1988). Finally, Donald Moore of *Designs for Change*, a Chicago-based organization which conducts research on big city schools, believes that a humane school environment can contribute to educational effectiveness, but beyond that, "believes that students, teachers, and parents have a right to experience a decent humane school environment for its own sake, since schools are not only institutions intended to achieve certain student outcomes, but also small communities in which students and adults spend a substantial portion of their lives" (Moore, 1991; 20-21). Beyond these few examples, little direct evidence exists that supports these assertions that the school facility impacts learning.

The Impact and Role of the School Building on Academic Achievement

What is empirically known about the impact and role of the school building on academic achievement was addressed by the research literature during the educational reforms of the 1960s. Interest in empirical research on the physical environment of the school and its impact and role in schooling was at its peak during a 20-year period beginning with the creation of the Educational Facilities Laboratory (EFL) in 1958 founded by the Ford Foundation to encourage and guide constructive changes in school facilities. Research significantly decreased in the late 70s after the demise of the open classroom movement and the rise of the conservative back-to-basics reform movement of the 1980s.

During this period, research on the physical environment included the analysis of the relationship between student and teacher behavior and attitudes, and student achievement measured through standardized test scores, with such physical variables as acoustics and noise, lighting, temperature, seating position, classroom furnishing layouts and design, windowlessness, class size and density, school size, and open versus traditional classrooms. Where these features of the physical setting have been examined for causal linkages to student achievement there has been minimal empirical support (see Weinstein, 1979). Since Weinstein's review, class size and school size research have been the most notable physical variables which have gathered significant evidence for a direct effect on student achievement (Achilles, 1992; Bourke, 1986; Glass et al., 1982; Barker & Gump, 1964).

There is considerable evidence that the physical setting directly effects both teacher and student behavior and attitudes. Literature is available on all the physical variables mentioned above in the previous subsection supporting the effect on behavior and attitudes. Research on open space schools provide one such example of this evidence. Open space schools, for instance, frequently lead to increased interaction among teachers, who feel a greater sense of autonomy, satisfaction, and ambition. They also place a higher value on evaluation by their colleagues than teachers in conventional schools . Open space schools generally appear to enhance students' participation: feelings of autonomy, willingness to take risks, persistence at a task, and an opportunity to meet more with teachers during the day, and engage in a greater variety of activities (Meyer, 1971 as reported in Weinstein, 1979).

Why such limited, ambiguous results in over twenty years of research? Is the physical environment insignificant to education or is there something missing in the

mode of research to account for the lack of positive findings? There are two identifiable reasons for the lack of substantial findings:

A question of methodology

There are many problems with methodology (see Weinstein, 1979). The most significant methodological problem is the mode of measuring academic achievement. The dilemma for environmental psychologists is that they must at some point in their research accept conventional time-honored methods of gathering information on student performance if they are to demostrate a connection with what educators consider evidence of achievement. However, the methods by which achievement is defined and evaluated in schools is coming increasingly under question. Traditionally, acheivement has been measured through the use of standardized multiple choice test scores. New proposals are challenging the validity of these methods and proposing alternative assessment strategies such as portfolios which fall under the rubric of outcomes-based education (Wiggins, 1993). As part of this debate, standardized tests have come under attack as true measures of academic ability. Claims against standardized tests include inadequate quality of materials, tests based on false assumptions, questionable test reliability and validity , and bias toward middle and upper-class whites which perpetuates and even exacerbates existing inequities in educational services particularly for minority students and those from low-income families (Neill & Medina, 1994).

Lack of theoretical models

The field has operated without a comprehensive theoretical framework from which to progress and build on previous research findings. The research does not seem to build on any collective understanding of what direction research should take. Weinstein (1979) and Gump (1987) are the only comprehensive reviews to date on the topic of the physical setting of the school. As a result, research conducted thus far has not been derived from an explicit theoretical model which takes into account the contextual variables of the educational environment such as socio-economic variables, organizational structure and policy. In addition, the majority of the research examines direct relationships between acheivement and physical variables without considering mediating effects of other physical, psychological, social and pedigogical factors.

Based on the findings of previous research, the general consensus of educational policymakers and public alike is that school buildings do not have a measurable effect on learning outcomes as measured by student achievement test scores. Seeing no real improvement in test scores over this period of great liberal experimentation in education, educational critics declared open education and classrooms a failure or at least not effective enought to continue programs and research in this area. This general perception has contributed significantly to the corresponding lack of public support measured in both tax dollars and general moral support for proactive school building programs across the country in the 1980s, despite the paradoxical increase in public school construction during the same period (Abramson, 1993).

Despite the lack of evidence and lack of public support for the notion that school buildings affect student achievement, many educators who work in school settings on a daily basis accept, almost axiomatically, that the physical setting of the school has an affect on the teaching and learning which takes place within their school. Anecdotal examples are cited continuously by educators directly involved in the daily operations of their schools. One junior high school student in Alabama summed up

the feelings of many educators faced with the rhetoric of reform when she stated: "They're always talking about 'we're the future of America,' and they won't even give us a decent place to learn" (Jackson, 1992; 6). Many individuals inside and outside the educational system feel that the issue of the role and impact of the school on student performance has yet to be resolved.

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Chapter 2

A CASE STUDY OF THE MILWAUKEE PUBLIC SCHOOLS FACILITIES MASTER PLAN

"There is no clear relationship between how well kids do in school and the facilities they occupy. Buildings that are in disrepair should be fixed because that is the prudent thing to do, and kids should be removed from cloak rooms because that is also the right thing to do. But none of this will necessarily improve education."
Mayor or Milwaukee, October 28, 1992

The controversy over the true impact of the physical setting on the quality of education is an important issue which has not been adequately addressed by either the educational or architectural communities. The current political drive to build new school buildings and renovate existing ones has not taken into account how school and classroom design actually impacts learning. The outcome of this debate will affect the way administrators, school boards and the public in general perceive to be the realizable goals of school design in relation to improved education for their children. The position taken here is that there is compelling evidence that the physical setting, among other psychological and social variables, has both direct and indirect affects on student learning outcomes -- the bottom-line quantitative measures of educational performance. This chapter will first discuss the social, economic and political aspects of this issue by presenting a case study: The Milwaukee Public Schools Facilities Master Plan. Secondly, empirical evidence supporting the notion that the physical setting has an influence on the quality of education will be presented through a brief literature review. Following that, the impact of class size reduction on achievement outcomes will be addressed with special attention given to the position taken by MPS. Finally, the debate over the role of the physical setting in learning within the context of the current school reform movement will be discussed.

2.1 THE CURRENT STATE OF SCHOOL FACILITIES & THE MPS FACILITIES MASTER PLAN

Public recognition that school buildings in many communities across the nation are in poor condition is growing. School buildings represent an important public asset and a major source of the cost of education. It has been estimated by a 1990 Educational Writers Association study that over $143 billion will be required nationwide for new construction, building renovations, and maintenance and repair over the next ten years. There are many reasons for the decline in the quality of school buildings in the last decade: (a) the discovery of hazardous building conditions, (b) the recognition that learning environments have become inadequate to meet new curriculum developments such as computer technology, (c) instructional modes such as individualized instruction, and finally (d) there is limited community desire to finance major construction projects.

In addition, it has even been argued that the decline in the quality of school facilities may be a significant factor negatively affecting student performance. In a recent study, Maureen Edwards (1991) claims that educational building conditions, such as deferred repair and renovation, in the Washington, D.C. area are influencing student

performance and estimates that improved facilities could lead to a 5.5% to 11% improvement on standardized tests.

Currently, many school districts across the country are in the planning stages of a massive upgrading of the facility infrastructure. Demographic projections indicate a continued increase in K-12 populations over the next 10 years. Despite the urgency, there is no consensus among the taxpaying public, state departments of public instruction, or local school districts as to what constitutes the real needs of schools and how best to address these needs once they are identified. In addition, there is little agreement among teachers, administrators, public officials or the public at large regarding the significance of these statistics, or whether school buildings even impact educational performance in any substantial way.

As a case in point, Superintendent Howard Fuller of the Milwaukee Public Schools in 1992 announced a $474.3 million facilities master plan for new construction and maintenance of existing school facilities in the district (MPS, 1992). The plan calls for preserving existing capacity (maintenance and repair) and increasing capacity by upgrading vocational and technical facilities, providing computer, art and music rooms, expanding kindergarten to all children who qualify, constructing a new technical high school, and additional classrooms to reduce overall class size.

In addition to the usual reliance on enrollment projections, the MPS Facility Masterplan was based on research by the Tennessee Star Program on the effect of class size on academic achievement. The recently completed program which followed some 6,500 children from kindergarten through third grade, found that as class sizes decreased, there was clear evidence of increased academic achievement. In addition, these same children continued to outperform their peers when placed back in traditional classrooms. The study also found that smaller class sizes were especially helpful for children of inner city schools (Miner, 1992).

The conclusion reached by the MPS facilities planning committee was that certain aspects of facility design do have an impact on student learning outcomes and that the findings of this research should be incorporated in the masterplan in the form of additional classroom space. A week after the MPS plan was announced, Milwaukee Mayor John Norquist presented a proposal for a $184 million alternative plan calling for a reduction in the amount of new construction and an emphasis on building maintenance. As part of his justification for proposing the alternative plan, Norquist strongly maintained that Fuller's plan offered no guarantee of improvements in education for children. Norquist stated,

"There is no clear relationship between how well kids do in school and the facilities they occupy. Buildings that are in disrepair should be fixed because that is the prudent thing to do, and kids should be removed from cloak rooms because that is also the right thing to do. But none of this will necessarily improve education" (*Milwaukee Journal*, Wednesday, October 28, 1992).

Placing the issue of improved educational performance into a larger economic and political context, Mayor Norquist has challenged Fuller to consider other types of policies which may have more of an impact on performance than improvements to physical infrastructure beyond maintenance (Parks, 1992; Hissom & Herr, 1992). The Mayor's office argues that staffing and teacher salaries or structural changes such as curriculum change, school choice, site-based management and other market-based

accountability measures may cost less and have a stronger impact on performance than reducing class size, or providing additional classroom space (David R. Riemer, personal communication, 12/8/92).

The debate over whether the physical setting has any influence on overall school climate is not at issue. Even critics assume, almost axiomatically, that the physical environment has an impact on a child's learning. Norquist, for example, admits without reservation that children should not be learning in cloak rooms or be required to spend their days in sub-standard conditions. The issue rather, is the extent to which the physical environment plays a role in *academic achievement.* The outcome of the debate will determine the degree of attention the physical environment will receive: a comprehensive examination of the environment's impact on learning, or merely the enforcement of minimum standards.

2.2 DOES THE PHYSICAL SETTING INFLUENCE LEARNING OUTCOMES?

Historically, concern for the physical environment of the school has been limited to the enforcement of minimum standards for classroom size, acoustics, lighting and heating -- the actual physical conditions of the school building itself. The assumption has been that as long as these basic requirements are met, the child's learning depends in large part on pedagogical, psychological and social variables (Weinstein, 1979). The role of the physical environment as a *variable* influencing learning outcomes has not been investigated extensively in the educational research literature. This second, more dynamic way of viewing buildings, as part of an interrelated component of a larger learning environment system, has rarely been addressed in the research literature.

In order to understand the current debate over the role of the physical setting on learning it is necessary to look at the school reform movements of the 1950's and 1960's; the origins of this debate. The open education movement of the 1960's is largely responsible for the increase in awareness of the impact of the physical environment on student behavior and attitudes. Right or wrong, architects designing new schools took a literal interpretation of the open education philosophy by creating *open* space schools. The rationale most commonly cited for these radical changes in design was economics, however it is obvious design was being driven by a new philosophy in education.

Much of what is known about the physical environment of the school is a direct result of research conducted under the auspices of the Educational Facilities Laboratories (EFL) established in 1965 and funded by the Ford Foundation. With the dissolution of EFL in the middle 1970's the research on the physical environment of the school has dropped off considerably.

The results of the empirical evidence generated during the open classroom experiments concerning the impact of the physical setting on learning have been mixed. Physical features which have been researched include such variables as seating position, classroom arrangement, open versus traditional classrooms, class density, noise, windowlessness and lighting. Where these features of the physical setting have been examined for causal linkages to student achievement there has been very little empirical support. However, there is considerable evidence that the physical setting directly effects both teacher and student behavior and attitudes. It

will be further argued that the impact of the physical environment on behavior and attitudes has an *indirect effect* on student achievement, an effect generally unappreciated by both researchers and educational policy makers.

In summarizing the results of almost fifteen years of research, Weinstein (1979) concluded that the physical environment of the conventional classrooms have not consistently demonstrated an impact on *academic achievement*. Furniture arrangements, aesthetic appeal, presence or absence of windows, classroom density, and short-term exposure to typical school noise all show no significant differences in achievement across comparative conventional classrooms. Open space classrooms, similar to conventional classrooms, do not appear to have any appreciable impact on student achievement either. The only physical variable to which differences in achievement has been significant is seating location, however the data is inconsistent.

Since Weinstein's review there has developed considerable evidence in the relationship between class size and student achievement. Glass et al (1982) conducted a meta-analysis of a collection of studies which looked at the impacts of class size and concluded that reducing class size from 30 to 20 can yield a gain of 6 percentage points on achievement scores, whereas a reduction from 20 to 10 students per classroom yields another 13 percentage points in achievement. They also found that reductions in class size begin to make substantial differences in learning achievement around 15 students per class.

There is considerable evidence that the physical environment can affect *non-achievement* behaviors and attitudes of both teachers and students (Weinstein, 1979): open space schools (Meyer, 1971; Pritchard & Moodie, 1971), small schools (Garbarino, 1980), small class sizes (Miner, 1992), classroom design modifications (Evans and Lovell, 1981) and the impact of the school's physical setting on the best of teachers and their desire to continue teaching (Johnson, 1990).

Open space schools, for instance, frequently lead to increased interaction among teachers, who feel a greater sense of autonomy, satisfaction, and ambition. They also place a higher value on evaluation by their colleagues than teachers in conventional schools (Meyer, 1971) and enjoy teaching in open-plan schools despite complaints about noise (Pritchard & Moodie, 1971). Open space schools generally appear to enhance students' participation: feelings of autonomy, willingness to take risks, persistence at a task, and an opportunity to meet more with teachers during the day, and engage in a greater variety of activities (reported in Weinstein, 1979).

Garbarino (1980) found that small schools, those on the order of 500 students, in addition to having lower incidence of crime levels and less serious student misconduct, encourage a sense of responsibility and meaningful participation, particularly among students who have academic difficulty and come from lower socio-economic backgrounds. Advocates of smaller class sizes claim that when class size gets smaller, teacher contact increases, classroom management improves, teacher stress decreases and teachers are more likely to try innovative techniques (Miner, 1992).

Evans and Lovell (1979) investigated the effects of a design modification in an open space alternative high school which was experiencing problems with student distraction, class interruptions, high noise levels, and poor traffic-flow patterns. Variable-height, sound-absorbent partitions were provided to redirect traffic away

from class areas and to define class boundaries. The result was that classroom interruptions were significantly reduced, and substantive, content questioning increased, while nonsubstantive, process questioning did not change.

This brief review of non-achievement findings strongly suggests that the physical environment plays an *indirect* role in student achievement. The research findings demonstrate evidence that a comfortable, attractive physical setting can be supportive of humanistic goals of education such as creating enthusiasm for learning, and encouraging positive social relationships (Weinstein, 1979). It is not unreasonable to suggest that more positive attitudes and behaviors on the part of children may reflect positively on improved achievement. It stands to reason then that positive attitudes and behaviors on the part of teachers would encourage, on the whole, higher quality teacher-student relationships resulting in further advantages for improved student achievement.

Admittedly, the extent to which the physical environment plays a role in the learning process remains an issue of contention. It is clear that the physical environment has been unappreciated for its potentially supportive role in student learning. The relationships between the physical environment, pedagogical, psychological and social variables have yet to be explored to any great extent by educational researchers. If the physical environment is more influencial than realized, as suggested by the significant findings on student and teacher attitudes and behavior, it will be incumbent upon educators to take another look at the factors upon which the child's learning depends. The next subsection will take a more in-depth look at one such factor, class size, within the context of MPS policy making.

2.3 CLASS SIZE RESEARCH AND THE PROPOSED MPS FACILITY STANDARD

Differences of opinion on the impact of the physical environment on learning may seem rather subtle, however the level of importance placed on the physical environment can have a profound impact on a school district's budgetary planning as illustrated in the competing Fuller and Norquist plans. One single research finding from the Tennessee Star Program accounts for a majority of the difference in cost between the plans: *as class sizes decrease to between 13-17 students, a significant increase in academic achievement is realized*. MPS has clearly taken a stand which promotes a more direct role of the physical setting up on learning than the Mayor is willing to commit.

There is considerable agreement in the research literature, that when class sizes are decreased, student achievement increases (Glass et al, 1982; Miner, 1992). Bourke (1986) went further by testing a causal model linking student, school, and teacher background information, class size, teaching practices, and mean class mathematics achievement. He found that the teaching practice variables that varied with class size and affected achievement were teachers' grouping practices, frequency and type of interaction with students, some aspects of teachers' questioning behavior, the amount of homework given, and the noise level tolerated during lessons. In summary, class size research almost exclusively emphasizes teacher practice variables without addressing physical environment variables which may impact learning as well.

The question of the role of physical classroom size in affecting student achievement has never been explicitly addressed by the research on class size. Class size is

typically defined as a student/teacher ratio independent of the size of the classroom space the class is contained in. In order to tie the physical setting to achievement, the relationship between class size and physical classroom size, or classroom density, needs to be made explicit. It has been argued by Gump (1987) that almost all class size studies have investigated reductions of the numbers of students in a classroom without complementary increases in physical classroom size and therefore, in general, these studies can be considered investigations in classroom *density*. Acceptance of class size literature as investigations in classroom, or social, density would suggest the physical environment of the classroom does play an as yet undetermined role in the overall class size reduction effect on achievement. Ironically, the emphasis on teaching practice variables in the class size literature has influenced the conclusions reached by the facility planning committee of MPS.

MPS has proposed a class size reduction facility standard as part of the Facilities Master Plan based on conclusions of the literature on class size (Miner, 1992). The new Board standard on class size reduces the student/teacher ratio for all kindergarten through grade two classes at all schools to 19:1 maximum. MPS claims that the standard should be focused at these early grade levels because (a) research indicates that the greatest benefit of class size reductions occurs at the early grades, and (b) the cost to reduce class size in all the elementary grades is too substantial. The new standard does not change class sizes in grades 3-5, middle schools, or high schools, where they will remain at an average of 27:1, 29:1 and 28:1 respectively. The policy on class size is intended to improve teacher morale and subsequently effect student achievement (MPS, 1992; 2).

In addition to reducing class sizes, physical classroom space will be increased to an average of 900 SF, up from 750 SF (in buildings constructed before 1960) and 864 SF (in buildings constructed after 1960). The reasons cited for the increase in classroom size were (a) the need to provide more space for educational media such as computer workstations and audio/visual equipment, and (b) provide more space for future program flexibility. One should note that these reasons for increasing classroom size were not related to the need to decrease classroom density. The relationship therefore between class size and physical classroom size have not been explicitly addressed. The role of the physical setting is as yet implicit in the facility policy making of MPS.

The MPS facility planning policy on class size provides a clear example of the need to develop more comprehensive models of the factors contributing to learning achievement outcomes; including not only psychological, social and pedagogical factors, but explicit physical environment factors as well.

2.4 CONCLUSION

Regardless of the political nature of the debate, Norquist's challenge to Fuller to look for more comprehensive and financially efficient ways to improve student performance is an important reality check. Certainly staffing strategies and structural changes within the school system are critical, in some cases less expensive, aspects to consider when attempting to achieve the goal of improved student performance. However, it has been the contention here that the physical setting has long been ignored as an equally important third factor in improved student performance.

The implications of yet another school reform movement, "Restructuring" in the 1990's, have again been ignored and overtly neglected with respect to the design of new school facilities. Similar to the problems faced in the 1960's, new concerns have been voiced over the current crisis of the American public school facilities. Should school facilities simply continue to be held to minimum standards, or is there a linkage between educational programs and the physical setting which would suggest a more comprehensive approach illustrated by the MPS plan?

Fuller's MPS Facilities Master Plan commits millions of dollars to the construction of new school classrooms based on the more significant empirical findings coming out of the research literature, that being school and class size. The plan also carefully considers the *location* of schools, advocating schools physically placed in the neighborhoods of the children they are designed to serve. Beyond the economic concerns of busing, MPS hypothesizes that neighborhood schools will fulfill a supportive community function further contributing to increased student achievement outcomes. There are many other potentially supportive design principles which the plan could have adopted, however, attempting to implement just these few research findings is relatively unique in school district facility planning. Mayor Norquist, on the other hand, would rather fall back on basic health and safety standards (passing up the opportunity to promote the supportive role of the physical environment on learning) in favor of school restructuring policies which arguably obtain the same educational goals for less cost.

The position that the physical environment has been neglected, and even ignored, and that it warrants attention of educators equal to other strategies for improving educational program effectiveness has been argued. It is clear that before educators begin to redesign their schools to meet the requirements of a new wave of reform, they must first rethink and reconceptualize the role of the physical setting in the educational process, and design settings which appropriately support their reform efforts.

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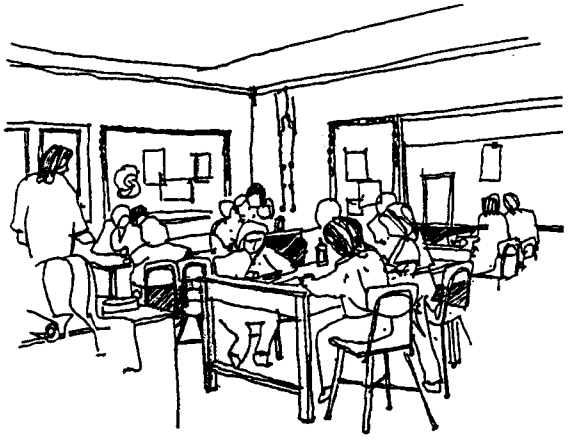
Chapter 3
PUBLIC ELEMENTARY SCHOOL ENVIRONMENTS: AN ANALYSIS OF THREE DISCIPLINARY PERSPECTIVES



"Although "solid proof" remains a distant goal, a picture of the environment's role in the educational process is gradually taking shape. It is a picture that is likely to please neither those who advocate minimally decorated, no-nonsense classrooms, nor those who call for "softer," more "humane" educational settings."
Carol Weinstein, 1979.

Carol Weinstein's view still holds in many ways as it did a full fifteen years ago. Evidence for the role of the physical environment of the school in the educational process continues to be mixed and ambiguous. There is, however, a growing body of knowledge from several disciplines that has continued to make strides in furthering our understanding.

This chapter looks at what is currently known concerning educational environments for public elementary schools and how this knowledge might be used to address some of the problems facing educational design and planning today. Three disciplines, educational psychology, environmental psychology and environmental design and research have addressed the problem of educational facilities from differing perspectives. The way each frames the problem affects what that field visualizes it. Therefore, questions such as, what is the problem? who defines the problem? and which approach best serves the problem at hand? become issues.

The analysis will discuss findings of each discipline concerning elementary school environments. Studies selected exemplify the various areas of research focused upon by each discipline[5].

The educational environment can be conceptualized as a series of relationships between educational administrative policy and procedures, teacher-student and student-student interaction and the physical environment within which all learning behavior takes place. Relationships between aspects of the environment and selected outcomes will be reviewed within the context of four interacting dimensions of the educational environment: personal, social, organizational, and physical. Interactions between dimensions include personal-social interactions, personal-organizational interactions, social-physical interactions. Relationships addressed by specific studies were categorized as focusing explicitly on any one of these dimensional relationships. Using this model, a clearer picture of the similarities and differences of the three disciplines emerged (See Figure 3.1: Comparison of Findings Across Disciplines).

[5] See the Appendix: Annotated Bibliography for further analysis of this body of literature.

Dimensional Interactions & Topic	Educational Psychology	Environmental Psychology	Environmental Design Research
Social-Organizational/Personal Dimension			
Organizational Development	Rowan, 1990		
Classroom Management	Anderson, et. al., 1979 Brophy, 1983		
School Climate	Anderson, 1982		
Programs & Services Evaluation	Illback, et.al., 1990		
Open Education	Stennett & Earl, 1983		
School Size		Garbarino, 1980 Barker & Gump, 1964 Fowler, 1992	
Class Size		Glass et. al., 1982 Miner, 1992 Bourke, 1986	
Teacher-Student Interactions		Gump, 1979	
Instructional Methods		Gump, 1979	
Personal/Physical Dimension			
Classroom Furnishings Arrangement	Winett, et. al.,1975 Loughlin & Suina, 1982	Gump, 1979 King & Marans, 1979	
Spatial Density, Crowding & Stress	Fagot, 1977	Conners, 1983 Zimring, 1981 Loo, 1976	
Seating Position	Daly & Suite, 1982 Schwebel & Cherlin, 1972	Adams & Biddle, 1970 Koneya, 1976 MacPherson, 1984	
Open Classrooms	Marshall, 1981 Olszewski & Doyle, 1976 Downing & Bothwell, 1979 Weinstein, 1977	Gump, 1979 King & Marans, 1979 Brunetti, 1972 Cotterell, 1984 Evans & Lovell, 1979	
Classroom Size		Gump, 1987	
Privacy		Moos, 1979 Mack, 1976 Brunetti, 1972 Ahrentzen & Evans, 1984	
Noise & Acoustics		King & Marans, 1979 Weinstein, 1979	
Climate & Thermal Confort		King & Marans, 1979 Humphreys, 1978	
Windowless Classrooms		Weinstein, 1979	
Vandalism		Zeisel, 1976	
Playyards			Taylor & Vlastos, 1975 David & Wright, 1975
Child Development			Sebba, 1986
Physical/Socio-Organizational Dimension			
Educational Program/Design Correspondence		Gump & Good, 1976	
Open Classrooms			Molloy et. al., 1972 Gross & Murphy, 1968
Educational Facility Development Process			Hill, 1984 Herman, 1990 Dierdorff, 1989 Day, 1985 Elliot & Davis, 1989 Ahrentzen, 1988 Caudill, 1978 Brubaker, 1988 Gaylaird, 1989
Participatory Design			David & Wright, 1975 Taylor & Vlastos, 1975 Sanoff, 1994
Environmental Management			David & Wright, 1975
Evaluation			Earthman, 1985 Hawkins & Lilley, 1986
Case Studies			Sanoff, 1994 Molloy et.al., 1972 Brubaker, 1991 Ramsey & Rydeen, 1989 Ficklen, 1988 Estes, 1984
Non-classroom Learning Settings			David & Wright, 1975
School Playyards			David & Wright, 1975
Environmental Awareness			David & Wright, 1975 Taylor & Vlastos, 1975
Community Schools			David & Wright, 1975 Molly et.al., 1972

Figure 3.1 Comparison of Findings Across Disciplines

3.1 EDUCATIONAL PSYCHOLOGY

Historically, the practice of school psychology has been conceptualized as a set of clinical psychological services provided in a school setting. A broad array of activities have been gathered under the umbrella of school psychology: new educational orientations, mental health approaches, student counseling, organizational development, program evaluation and special education. School psychology's as a field has been seen less as a development and more as a diverse accumulation of practices and perspectives with no cohesive theoretical base or objectives for practice (Cobb 1990).

In addition to the long list of services school psychology is seen as providing in practice, a diverse literature has developed regarding the study of educational environments. Several research areas linked to school environments are research on effective schools literature (Bickel 1990), school psychological interventions including program planning, development and evaluation (Illback, Zins, Maher & Greenberg, 1990), effective teaching, instructional and environmental variables (McKee & Witt, 1990), and the use of the physical environment as a creative instructional aid (Loughlin & Suina, 1982.)

Effective schools literature developed in the 1970's, in response to initial criticisms concerning the ineffectiveness of schooling as it pertained to populations of at-risk children in the 1960's (Bickel, 1990.) Several assumptions were identified as accounting for differences in achievement outcomes: age of school building, instructional facilities, class size, teacher background, social inequalities, etc. Effectiveness was defined in terms of the basic skills achievement of students. Dimensions of effective schooling include leadership (positive climate, goal-focused activities, classroom management, in-service staff training), efficacy (press for excellence, academic reward system, cooperative activities, adaptive practices, levels of task difficulty) and efficiency (effective use of instructional time, orderly school and classroom environments and evaluations.)

McKee and Witt (1990) have argued that even though many school psychologists implicitly, or explicitly, recognize the impact of environment on student behavior, this knowledge is often not considered when designing service delivery interventions. Instead, they argue, school psychologists continue to focus on child variables such as the child's behavior, intelligence, learning style and deficits, without considering environmental variables affecting these child variables. Interventions assume problems exist within the child not within the instructional environment. They distinguish between two main categories of environmental variables; teacher behavior and degree of classroom management, and classroom arrangement of furnishings, learning centers, etc., which are seen as influencing student behavior, learning and achievement. The problem as McKee and Witt see it is that teachers can design attractive bulletin boards and develop lesson plans, but require training in learning what types of questioning behaviors to use, or how furnishings and learning centers should be arranged. Programs could include services to train teachers in these areas.

Educational psychologists have framed "the problem" of schools as one of student *achievement* normally defined by measured academic performance on standardized tests. The approach to addressing this problem is one of identifying the salient influences on achievement of students, whether that domain be psychological, social, economic, political or, on occasion, the physical school setting. As would be

expected, research in educational psychology is, as a result, strongly influenced by prevalent educational philosophies of teaching practice. One limitation of this approach is the reliance on narrow conceptions of what constitutes achievement and performance in children. Many other non-achievement outcomes are recognized, but rarely researched empirically within the larger environmental context. Another limitation often cited is the underemphasis in educational psychology of the influences of the physical environment on behavior of both teachers and students (Weinstein, 1979; McKee & Witt, 1990.) The relationship most researched by educational psychologists was found to be organizational/ individual interaction.

3.1.1 Educational Psychology: Social-Organizational/Personal Dimension Interactions

Some of the issues covered by educational psychology under the organizational category are organizational development, classroom management, school climate, programs and services evaluation, teaching styles and philosophy, and issues of open programs.

Organizational Development

The political dynamics of the problem, as seen from the field of education, has been cogently articulated by Rowan (1990). Two waves of inconsistent and potentially incompatible reform initiatives occurred during the 1980's. WIth the first wave of reform, many large urban districts and state legislatures responded to the problem of low achievement in schools by increasing bureaucratic controls over curriculum and teaching. In reaction to this approach, the argument countered by critics was that bureaucratic controls are incompatible with the professional autonomy of teachers and potentially damaging to teacher morale. Thus, many observers see a second wave of reform that advocates decreasing bureaucratic controls in education and the creation of working conditions in schools that enhance the commitment and expertise of teachers.

There is a need to understand how bureaucratic controls over schooling affect the work of teachers and whether these effects lead to changes in student outcomes. There is also a need to understand how organizational structures that support decision-making in classrooms affect the work of teachers and how these structures can improve student outcomes.

Classroom Management.

Classroom management grew out of the effective schools movement of the 1970's and attempts to understand the ways effective teacher's handle student misbehavior. A study by Anderson, Evertson and Brophy (1979) supported the findings of Kounin (1970) that "with-itness", overlapping and signal continuity and momentum are important to overall mangement and improved student learning. The study analyzed how teachers in a variety of settings handle student misbehavior. It was hypothesized that the way teachers managed misbehavior affected not only the individual involved but had a ripple effect on other students who observed the event. Although effective teachers did not appear to have clear methods for dealing with misbehavior, they did exhibit group management skills. With-itness refers to the teacher's ability to be aware of, and respond to student behavior, and detect inappropriate behavior early. Overlapping refers to the teacher's ability to manage more than one activity at a time. Signal continuity and momentum refers to the ability of the teacher to manage well-planned, smooth and briskly paced instruction by presenting a continuous "signal" or task to students which provides sustained momentum.

Brophy (1983) identified a set of procedures for estimating effective management which includes classroom rules, plan classroom procedures (student use of classroom space and facilities, transitions in and out of room, procedures for teacher-led instruction and seatwork, planning student participation, communicating assignments and work requirements), providing procedures for student accountability and managing appropriate behavior.

The work on clarifying classroom management strategies is a clear example of the intervention research approach of educational psychologists. Classroom management has been applied directly in the educational setting through pre-service and in-service teaching training programs.

School Climate

The research literature on school climate is extensive and will not be covered here, but it is included as an example of a third type of approach educational researchers have taken to understand the whole of the educational environment and its effects on students. Anderson (1982) has reviewed the literature on school climate research concerned with understanding the effect of schooling on students by investigating *what to look at* in schools and *how to look at it.* Definitions of school climate have been conceptualized as dealing with broad constructs such as total environmental quality within the school organization. There is some agreement that schools possess "climate" which is unique to the organization and is influenced by student body characteristics and classroom processes, however, it is difficult to describe and measure.

School climate is hypothesized to influence student outcomes such as behavior, values, personal growth and satisfaction and if these influences were understood predictions of student behavior would follow. Typically, empirical research is conducted using climate instruments such as questionnaires, interviews, observations and records. Several categories of variables have been found to be tied to climate and/or student outcomes:

1. *ecology variables*: building characteristics, size;

2. *milieu*: teacher and student body characteristics, teacher and student morale;

3. *social system variables*: administrative organization, instructional program, ability grouping, administrator-teacher support, teacher and student shared decision-making, good communication, teacher-student relationships, opportunities for student participation, community-school relationships;

4. *cultural variables*: teacher commitment, peer norms, cooperative emphasis, expectations, emphasis on academics, rewards and praise, consistency, consensus, clear goals.

Dependent variables under study include school discipline, student asperations, achievement, control attitudes, attendance and behavior, bureaucratic structure, and climate dimensions and type. Because of the broad nature of school climate, researchers cannot agree on either the possiblity or desirability of indentifying climate (Anderson, 1982).

Programs and Services Evaluation

The area of program and services evaluation in educational psychology is too large to be covered in any great detail in this publication. It is important to note, however, that program planning and evaluation is a fourth major source of knowledge for educational researchers.

Program planning and evaluation is seen as an organizational change intervention strategy, focusing primarily on management and decision-making issues within the organization. Planning and evaluation of educational services and programs are conducted primarily to monitor quality of educational programs and practices from many different scales and perspectives: from individuals and classroom settings, to buildings and school districts. Programs developed by educational psychologists may focus on either the prevention or remediation of problems experienced by children and teachers, or families and whole school systems. For example, the development of a comprehensive student services program might include assessment and instructional and related services, personnel development and administrative services. The program will often identify specific facility locations, required spatial configurations and equipment needs to support the services recommended. (Illback, Zins, Maher & Greenberg, 1990)

Outcome or impact assessment is used as a way of describing the effects a program has had in achieving its pre-stated goals. Program evaluators tend to use a broad range of approaches. Evaluative questions formulated are chosen as a function of some general decision-making area under consideration. Such general decision-making areas include internal program operations and effects, external accountability requirements, and scholarly knowledge. In making decisions concerning program effectiveness in school field settings, problems of experimental validity can arise reducing the ability to generalize findings to other school settings (Illback, Zins, Maher & Greenberg, 1990).

Open Education

The implications of open education, a teaching style which developed in the 1950's, has been the backdrop for a large majority of research in the last thirty years. Much of the research in educational psychology has paralleled environmental psychology in the sense that field research has taken place primarly in open plan schools which developed partially in response to open education programs. The following study typifies the type of research done on open education in educational psychology.

A survey was conducted by Stennett & Earl (1983) in which 131 Canadian elementary school teachers working in open space classrooms were to determine to what extent open education concepts were being implemented, in addition to eliciting their opinions about the problems connected with implementation. The survey asked teachers to rate ther personal preferences on 11 scales concerned with planning and organization and 13 scales concerned with provision of instruction. Responses to the survey suggested that teachers saw the strengths of open areas to be identified with sharing of ideas, techniques, and materials; team teaching and cross-grade grouping of students; providing personal and professional support from colleagues; and capitalizing on the special strengths and talents of teachers. The weaknesses cited included noise and distraction, limits on spontaneity in teaching, and occasional disagreement between team teachers.

3.1.2 Educational Psychology: Personal/Physical Dimension Interactions

Areas of research covered under individual/physical settings interactions within educational psychology deal primarily with student achievement and performance with respect to classroom furnishings arrangement, spatial density, crowding and stress, seating positions and the affect of open classrooms on individual performance. Much of this research shares a common interest in the impact of the physical environment on achievement with environmental psychology. It could be argued that much of the research represented as educational research has been inspired by the earlier work of environmental psychologists, and is an extension of that domain of research. The following studies exemplify the type of research conducted in each area.

Classroom Furnishings Arrangement.

Winett, Battersby and Edwards (1975) examined whether changes in seating arrangements, individualized instruction, and group contingencies placed on academic work would change behaviors of an initially disruptive classroom. An intervention was tested in which desks were changed to cluster arrangements, individualized instructional materials were provided and group contingency rules were initiated. Student behaviors were observed, teacher instruction was coded, academic performance was recorded and measures were taken pre- and post-intervention. It was found that individualized instruction with group contingencies increased academic production, improved social behavior and changed teachers' interaction with children.

From a more strategic, educational instruction perspective, conceptualizing and using the environment as a general instructional tool for learning goes well beyond the more conventional ways of thinking of the physical classroom environment that being in terms of architecture and furnishings such as chairs, desks and shelves (Loughlin & Suina, 1982). Loughlin and Suina describe ways in which the arrangement of the classroom environment can be seen as a tool to support the learning process. They argue that teachers have not been trained to look at the environment in non-traditional ways. They present practical information and environmental assessment procedures for making the learning environment supportive. They discuss problems of organizing space to maximize learning areas, relieve crowded conditions, visualize classroom space in new and creative ways, subdivide the room into smaller work areas, create message centers, define paths and traffic patterns with tall furniture, create a variety of spaces within the classroom, and create displays. They also provide an appendix of observed behavioral problems and give suggestions of possible environmental sources.

Spatial Density, Crowding and Stress.

Fagot (1977) examined children's behavior in a natural setting with varying degrees of density. Children from the U.S. and Netherlands were tested according to measures of high, medium and low densities. Behavioral observations were taken of children and teachers. It was found that childern interacted more positively and played alone more in high, rather than in low or medium density conditions. The researchers recognized the limitations of the study by indicating possible differences in cultural context and social organization of classrooms.

Seating Positions

Daly and Suite (1982) looked at teacher's initial judgements of students in relationship to their seating position by asking teachers to make an evaluation of the student given a seating chart, students' chosen seat, sex and grade. Results indicated a significant effect for seating on teachers' evaluations of students in line with previous research linking seating position to participation and achievement (Adams & Biddle, 1970). For example, students siting closer to the front were regarded more favorably than those siting in the rear.

Schwebel and Cherlin (1972) investigated possible differences in the attitudes and behaviors of students in different seating positions. Behavioral observation as well as student and teacher self-administered ratings were used in the study. Pre-intervention (teacher assigned seating) revealed that students in front engaged in more of their own work and were less inactive than students in the back rows. Post-intervention (randomly assigned seating) revealed that students who moved forward were seen as more attentive and likeable by the teacher. Students tended to rate their front row classmates as more attentive, more shy and likable by the teacher. Students in the front saw themselves as smarter than those in the back.

Open Classrooms

Educational research has not sought to establish a link between buiiding design and learning outcomes, and the research on the effects of open schools on learning and achievement as measured by task performance remains inconclusive (Marshall 1981, Weinstein 1979). Open classrooms have, however, been found to influence cooperative teacher behaviors (Olszewski & Doyle, 1976.)

Downing and Bothwell (1979) considered the hypothesis that architectural open space schools promote peer interaction. The authors found that students in an open-space school would more likely choose seating reflecting expectation of interaction rather than coaction, develop cooperative interdependence in a controlled game-playing situation and develop beliefs reflecting an internal locus of control.

Weinstein (1977) hypothesized that specific changes in the physical design of open classrooms can modify students behaviors. The study consisted of observations of students' behavioral reactions to rearranged furniture, added shelving , a raised reading platform and the addition of a cardboard private area. Comparison of pre and post-intervention revealed that the distribution of students across rooms became more even, girls used science and game areas more, and the use of manipulative materials and games increased.

3.1.3 Educational Psychology: Physical/Social-Organizational Dimension Interactions

Educational psychology has had a limited interest in the relationship between the physical setting and the organization. This lack of interest may be due to the dominant focus of research on the factors which affect the individual child, rather than on the relationships that exist between these factors.

In summary, educational psychology has concentrated more exclusively on organizational/ personal relationships such as organizational development, classroom management, school climate, programs and services evaluations and open education. Much of the research conducted within the context of personal/physical dimension relationships such as classroom furnishings and seating positions, spatial density,

crowding and stress, and open plan classrooms have paralleled research efforts of environmental psychology. Educational psychologists have a problem-centered approach which not only identifies variables influencing child achievement and performance, but also conducts specific program interventions in attempt to alleviate those problems. From this action-centered research, difficulties can arise as to the validity and generalizability of findings.

3.2 ENVIRONMENTAL PSYCHOLOGY

Conventional wisdom assumes, and it is a universal belief among educators, that the physical environment has an affect on the behavior, achievement and performance of students and teachers even though this belief cannot be empirically demonstrated (Earthman, 1986; McGuffey, 1982; Weinstein, 1979.) Given this assessment, the field of environmental psychology continues to define the problem of educational environments as one of systematically identifying all social and physical environmental influences on student achievement and performance within the classroom. This approach to research in the discipline of environmental psychology is the most empirically based of the three disciplines reviewed. The goal of research is to inform educational policy decision-makers by presenting empirically tested results. The research focus is primarily on the child and teacher in the classroom setting. In this regard, the field is similar to educational psychology, with the exception that empirical studies attempt to include a more comprehensive set of physical environmental variables such as noise, classroom furnishings, spatial density, seating positions and other variables.

A review of the environmental psychology literature indicates considerable agreement among several reviewers (King & Marans, 1979; Gump, 1978, 1987; Weinstein, 1979).

King & Marans (1979) completed an extensive search of the literature on the relationship between the behavior of individuals and their educational environments. The empirical studies reviewed concentrated on academic achievements of children in non-traditional settings. Research findings were summarized according to six major categories of the school building environment. The first three categories are concerned with the basic interface between the educational program, its basic philosophy, and the physical design of the building -- non-traditional instructional space, school size, space and density. The remainder of King & Marans' categories concentrate on the physical aspects of the design of instructional facilities and their impact on the educational program and its participants -- climate lighting, acoustics and color and miscellaneous (furniture and equipment, age of physical plant and participatory design).

From a review of the literature on educational environments, by Paul V. Gump (1978), several dominant areas and approaches to education environments research can be identified: research on classroom settings, conceptualizing the environment as an independent variable influencing student behavior, student-teacher interaction research, traditional versus open classroom arrangement comparisons, and the impact of teaching methods on student involvement and academic performance.

Weinstein (1979) reviews the research on the impact of classroom environments on student behavior, attitudes and achievement. She examines six environmental

variables listed as follows: seating position, classroom design, density and crowding, privacy, noise and windowlessness. She also offers a short discussion of ecological psychology and open classroom research.

Of the three sub-system interactions, environmental psychologists have generally focused their research on personal/physical dimension relationships.

3.2.1 Environmental Psychology: Personal/Social-Organizational Dimension Interactions

Environmental psychologists focus less on organizational issues than educational psychologists, mainly concentrating their efforts on classroom specific program issues such as teacher and student attitudes, behavior and achievement.

School Size

Between the early 1960s and 1980, 344 articles were published pertaining to the effects of school size on academic achievement and other achievement-rated variables (Garbarino, 1980). Barker and Gump (1964) conducted a study of a sample of high schools larger than 2000 students and very small on the order of 100-150 students in Kansas. They concluded that small schools offered students greater opportunities for participation and to exercise leadership roles. In particular, participation in school activities, student satisfaction, number of classes taken, community employment, and particiation in social organizations were all superior in small schools relative to large schools. Garbarino (1980) reported small schools also have lower incidence of crime levels, less serious student misconduct.

Other studies have looked directly at the question of the impact of school size on academic performance. Fowler (1992) argued that the issue of school size effects at the elementary school level, based upon 'the number of students and the general agreement of the findings' (p.1) is conclusive. He summarized the research of a numberr of corroborating studies reporting a negative relationship between math and verbal ability tests and elementary school size; larger elementary schools being detrimental to student achievement, even holding student income differences constant; smaller elementary schools particularly benefitting African-American students' achievement; and a negative relationship between school size and student performance being most prevalent in urban schools (Fowler, 1992).

Class Size.

There is considerable agreement in the research literature, that when class sizes are decreased, student achievement increases (Glass et al, 1982; Miner, 1992). Bourke (1986) went further by testing a causal model linking student, school, and teacher background information, class size, teaching practices, and mean class mathematics achievement. He found that the teaching practice variables that varied with class size and affected achievement were teachers' grouping practices, frequency and type of interaction with students, some aspects of teachers' questioning behavior, the amount of homework given, and the noise level tolerated during lessons. In summary, class size research almost exclusively emphasizes teacher practice variables without addressing physical environment variables which may impact learning as well.

Teacher-Student Interactions.

According to Gump (1979), early quantitative studies often approached school environments by focusing upon individual inhabitants such as students and teachers. In addition, studies focused on the behavior of important agents in the educational

environment. For example, behavior of principals and teachers were studied to understand their influence on the educational process. Teacher-child interactions have been investigated where performance was studied as a function of the location of the student from the teacher, as well as the child's physical location in a classroom. It had been reported that even lesson types and subject matter formats can affect interaction with students as a whole group and as individuals.

Instructional Methods.
Experiments have been conducted wherein teaching formats themselves were changed. Gump (1979) explains that normally teachers dominate class time talking to, and asking questions of students, while students' involvement is limited to answering questions. Cooperative formats studied in comparison to competitive formats, within the context of simulation games, have proven to assist academic learning and enrich classroom experience.

3.2.2 Environmental Psychology: Personal/Physical Dimension Interactions

Environmental psychologists, unlike educational psychologists, are concerned with research which accounts fully for physical setting variables in providing a more comprehensive view of the classroom setting. Environmental psychologists, when dealing with personal/physical dimension relationships, focus on seating and classoom furnishing arrangement, spatial density, crowding and stress, privacy, noise and acoustics, climate and thermal comfort, lighting, vandalism, and open classrooms.

Seating Position
Research into the effects of seat location in traditional row and column seating arrangements have been studied more than any other variable (Weinstein, 1979). From this research, the concept of the action zone has been conceptualized. This zone refers to the tendency of students who sit 'front and center' to have the highest rate of verbal interaction and participation. In addition, teachers tended to call on students in the action center more often (Adams & Biddle,1970; Koneya, 1976).

More recently, MacPherson (1984) conducted an ethnography of nonacademic aspects of student choice behavior in relation to peer group sociability in spatial distribution of classroom interaction. The intent of the study was to indicate the importance of student definitions of the classroom. Interviews were conducted with students about seating preferences. The study found that students tend to sit in areas of the classroom which are in accordance with their goals, provide opportunities for action and control of each other and the teacher, and in addition to academic achievement.

Classroom Size
The question of the role of physical classroom size in affecting student achievement has never been explicitly addressed by the research on class size. Class size is typically defined as a student/teacher ratio independent of the size of the classroom space the class is contained in. In order to tie the physical setting to achievement, the relationship between class size and physical classroom size, or classroom density, needs to be made explicit. It has been argued by Gump (1987) that almost all class size studies have investigated reductions of the numbers of students in a classroom without complementary increases in physical classroom size and therefore, in general, these studies can be considered investigations in classroom *density*. Acceptance of class size literature as investigations in classroom, or social, density would suggest the physical environment of the classroom does play an as yet undetermined role in

the overall class size reduction effect on achievement (see literature on class size in previous sub-section).

Classoom Furnishing Arrangement.
Studies of the affects of innovative spatial arrangements on student's general behaviors have been conducted. Clear relationships have been identified for such student behaviors as movement patterns, purposefullness, disorderliness, persistence and participation and attitudes toward class and other students. However, no clear relationships were found between spatial arrangement and verbal interaction or academic achievement (Weinstein, 1979). King & Marans (1979) highlight the potential for considering the relationship between teaching techniques, furnishings and open plan arrangements, and the potential for using furnishings (screens, cabinets) to provide for visual privacy traditionally provided by architectural partitioning systems. Rivlin and Rothenberg (1976) examined the distribution of furniture and activity in elementary school open classrooms by using behavioral and furniture mapping at three times during the school year. On finding of their study was that the physical layout of the classrooms remained quite stable over the course of the year.

Spatial Density, Crowding and Stress.
Although some attention has been given to preschool environments (Gump 1979), Weinstein (1979) reports that few field studies had been completed on density and crowding for elementary school settings. She goes on to suggest that most work on density and crowding has been done in experiemental studies primarly investigating determinants of perceived crowding, and the effects of crowding on task performance. Overall, the studies are inconclusive regarding the affects of density and crowding in classroom settings. On the other hand, King & Marans (1979) report that literature on space and density indicates that sufficient space for a child is an important consideration. In the case of younger children, an increased density can influence various behavioral problems, and has a tendancy to lower levels of satisfaction.

In a review of the available literature on stress and the school environment, Conners (1983) suggests that the designed environment of schools may stress users of the facility both directly and indirectly at both the classroom and school-wide levels. The author follows Zimring's (1981) conceptualization of stress as arising from a misfit between individual needs/goals and environmental attributes. The physical environment can influence levels of stress at the macro-environmental scale by affecting the social interaction, wayfinding and spatial orientation; and at the micro-environmental scale by seating position, classroom design and arrangement, density and crowding, privacy and noise.

Conners (1983) outlines several implications from the research. Schools need to allow for places which can enhance goals for social interaction, foster social networks, and provide the opportunities to control the time and place for social interaction, such as student lounges and gathering places. These types of spaces may have an indirect affect on levels of stress in school environments by providing a sense of choice and control over where and when social interactions take place. In an effort to decrease the stress associated with problems with wayfinding, schools can be planned using landmarks with visible and distinctive colors and symbols.

Loo (1976) conducted a study in which the effects of spatial density of the behavior styles of children were affected. Behavioral observations were made of 75 five-year-

olds at play in pre-school classrooms in which it was revealed that as the number of students increased in the classroom, aggressive behavior also increased. In addition, it was found that as pupil density increased, movement and distraction also increased.

Privacy

Although there have been no systematic studies of environmental antecedents of privacy in the classroom, privacy opportunities have been noted as an important feature of learning environments (Moos 1979, Weinstein 1979). Educators have advocated private places in classrooms as necessary for providing opportunities for conversations and solitude (Mack, 1976). There is evidence that open classroom designs may offer more opportunities for privacy than traditional design (Weinstein, 1979). Decisions concerning issues of privacy have been made by educators generally without empirical support. A few studies have looked at the affects of study cubicles on task performance, activity level and handicapped children. The study of privacy within the context of the school in general has been given very little attention, although a few limited studies have been conducted.

An eariler study of privacy has suggested that even though open-space schools have less interior walls than conventional schools, and would seemingly provide less opportunities for privacy, they may offer more opportunities for solitude and seclusion than traditional schools (Brunetti, 1972).

Ahrentzen and Evans (1984) conducted a more recent study in which environmental features of elementary school classrooms are examined in relation to their contribution to distraction and privacy to students and teachers. Classrooms were measured according to interior spaciousness, degree of open perimeter and amenities for private study. Interviews were conducted with students and teachers. Teachers' adjustments of their activities to reduce distractions correlated with the amount of nonstructural walls in the classroom. Students were reported to have had limited access to amenities for private study.

Noise and Acoustics

Research on environmental antecedents of classroom distraction has focused almost exclusively on noise. Studies reported by King & Marans (1979) and Weinstein (1979) both indicate that studies examining short-term exposure to noise indicate no impacts of noise level on academic achievement of normal students. Some evidence suggests that handicapped students are generally more affected by noise than normal students . Reactions of students to noise seem to be related more to general moral. Acoustically absorptive environments are generally prefered by students and teachers, while audio-visual equipment continues to be a problem acoustically (reported in Weinstein, 1979). The King & Marans study recommend reviewing the research on open offices acoustics to find generalized findings which can be applied to school settings. In addition, little research on the affects of short-term versus long-term noise exposures on children has been conducted (Weisman, 1979).

Climate and Thermal Comfort

According to the review by King & Marans (1979), climate factors such as temperature, humidity and air movement all have impacts on academic achievement and task performance, attention spans and levels of discomfort. Air conditioning has the affect of improving conditions in all these variables, however, economic conditions often prevent this option for solving the problem. In one study for instance, Humphreys (1978) investigated thermal comfort and response to climate

change in the classroom of primary school children in the summer months. Temperature measurements, observations and questionnaires were used in the research. The study concluded that discomfort was related to a change in temperature rather than to the temperature itself; the greater the change in temperature, the more often students complained of heat or cold.

Windowless Classrooms

Advocates have stated advantages of windowless classrooms that range from freedom from heat gain, glare and distraction, increased wall space for storage and bulletin boards, and opportuities for more flexible room arrangements. Critics have emphasized disadvantages such as the lack of visual access to the external world as well as claustrophobic reactions. Studies have indicated the absense of windows does not affect student performance postively or negatively, while attitude surveys are inconclusive indicating a range of responses from positive to negative (Weinstein, 1979).

Vandalism

Zeisel (1976) identifies typical school building features which increase the probability of property damage. Vandalism is most likely to occur in locations where students gather in groups to play and socialize.

Open Classrooms

In terms of architectural interventions the open space classroom is a milestone in the history of school design which has traditionally been characterized by the 'egg-crate'. Fifty percent of all schools built between 1967 and 1970 were open space design. While the period of open school design is past, the buildings remain. Open-school environments were constructed during the 1960's and early 1970's based on ideological support for the open school program philosophy and the claim that these buildings would cost less to construct.

Open programs, it has been argued, provide more opportunities for children in terms of providing educational freedom and autonomy for self-directed study, require less guidance by the teacher, and help foster self-responsibility on the part of the student. The disadvantages included the student wasting time moving from activity to activity, less time focused on educational tasks, and perceived noise by teachers. Another problem with the open school plan was the fact that many schools were still using traditional school programs. Gump (following Barker, 1968) suggests schools using traditional school programs in open space designs violate the "synomorphy" of behavioral settings. As a result, teachers erect substitute partition walls to set up barriers from distraction and noise problems. Some schools have gone as far as to renovate existing open classroom arragements to include new sound proof walls even if the room sizes are of awkward shapes and sizes (Gump, 1979) .

The relationship between academic achievement and open space is inconclusive (Weinstein, 1979). It is clear from the research that academic achievement is not a function of the openness of facilities, however, teachers do hold positive attitudes towards their jobs and their schools in open plan/open program schools, and students' attitudes and self-images are generally better (King & Marans, 1979). In addition, teacher attitudes seem to indicate greater feelings of autonomy and satisfaction, increased interaction among teachers and an overall enjoyment in teaching regardless of persistent noise problems. Student attitudes towards open classrooms is similar to

teachers' experiences: they maintainedan increased sense of autonomy, and engage in a greater variety of interactions and activities (as reported in Weinstein, 1979).

One problem with measuring achievement against open plans concerns the differences in educational philosophy between traditional and open programs (Weinstein, 1979). King & Marans (1979) suggest that achievement is normally measured by looking at intelligence and socioeconomic background, and because of this fact, it is not surprising that the school building design has not shown a major impact on learning. They suggest that decisions to plan for traditional versus open schools should be based on other factors aside from achievement, such as the attitudes of teachers and students and styles of teaching and learning. The study recommends that research focus more on the management of educational facilities at a scale larger than the classroom setting to see if it is possible to more closely link educational philosophy with architectural layouts of entire school buildings.

Empirical studies on open classrooms provide an opportunity for integrating all the preceding environmental antecedents. The following three studies are examples of how acoustic and visual privacy, noise, anxiety, interruptions, design interventions and student and teacher behaviors can be researched within the context of the open plan classroom.

Brunetti (1972) surveyed two open-space and one conventional school in an attempt to discover how often students were able to find an adequate place to study alone when they desired, 50 percent of students in the open-space schools responded favorably, while only 25 percent of students in the conventional school responded favorably. To study the opportunities for achieving *acoustical and visual privacy*, high school students in one open-space and two conventional buildings were asked to indicate how often they were unable to locate a quiet place for individual study. About 25% of students in all three schools were unable to screen out *noise*, however, 27% of students in the open-space school were unable to find a visually secluded place versus 34% and 40% for the two conventional schools. Although this study consisted of a small sample and was a self-report format, the implications for providing privacy in schools is evident.

Cotterell (1984) studied student diaries of events to identify three categories of anxiety related to differences in student personality and school design (open plan or conventional). Follow up observations were conducted of student and teacher behavior in class settings. The study found that students in open plan schools had higher levels of school work anxiety than students in conventionally design schools. Teachers also experienced more tension and anxiety in open plan schools than conventional, and transitions to new activities in open plan classrooms took longer and student off-task behavior was greater.

Evans and Lovell (1979) found that partitioning of an open-space high school resulted in decreased classroom interruptions, increased content questioning and decreased process questioning.

3.2.3 Environmental Psychology: Organizational/Physical Dimension Interactions

There were few references to the relationship between the form or structure of the physical environment and the organizational policies and goals of the school.

One exception was found in a study by Gump and Good (1976) which examined the relationship between the educational program and architectural design in open and traditionally designed schools. The researchers used behavior and location mapping techniques to follow children throughout the day focusing on types of activities, duration of activities, group size and location, and in addition interviewed teachers. It was found that at the primary level, open schools use more learning sites and spend more time in nonsubstance activity than those students of traditional schools, yet teacher leading activity was more predominant in open schools.

In summary, environmental psychology is primarily an empirically driven discipline. Environmental psychological research has focused almost exclusively on the classroom setting. It is clear that the classroom is by far the most heavily utilized physical space in the school, especially at the elementary school levels and there is good reason to study this setting. Environmental psychologists have generally focused on two main categories of research: the affects of space and density, climate factors (light, noise, air conditioning, windows) and furniture arrangements on children and child-teacher interactions; and, the affects of open plan/open space schools on children, teachers and child-teacher interactions.

The conception that the problem of educational environments is one of systematic inquiry of environmental influences on children within the classroom setting carries with it limitations. To what extent the research is linked to specific educational philosophies, programs and policy decisions is unclear. The indirect impact of environmental psychology on educational policy does not appear, however, to be a limitation shared with environmental design and research.

3.3 ENVIRONMENTAL DESIGN RESEARCH

While environmental psychology has systematically focused on the classroom setting and has asked the question, what is going on and why?, the environmental design literature has focused on the educational facility as a whole, and has asked the questions, what are the problems or issues? and how can we change and improve what exists? For instance, David and Wright (1975) present perspectives on the changing notions of what constitutes a learning environment, and propose various ideas of what it could be. Other architectural literature focuses on the planning and design of learning environments (Sleeman & Rockwell, 1981), while other reviewers rely on case studies as a basis for developing knowledge about educational facilities (Ballast, 1987), general design guidelines/ strategies for educational planning (Taylor & Vlastos, 1975), and evaluating educational facilty pilot studies (Molloy et al., 1972).

Environmental designers and researchers see educational environments as a design problem; a problem of identifying needs and translating those needs into built form. A goal of environmental design research is the desire to integrate many different educational perspectives, goals and philosophies on the one hand, and provide a supportive physical environment for learning on the other. Another aspect of the problem for the environmental designer is the desire to predict *future needs* and trends.

The approach used by the environmental design research field for generating knowledge of educational environments relies on anecdotal evidence compiled from independent practitioners' personal experience, research utilization strategies such as post-occupancy evaluations and design guides, and selective case study analyses of exemplary projects. The limitations of this approach is that knowledge is not always empirically tested, or if it is, it may not be generalizable enough due to the methodological shortcomings of conducting field research. Knowledge in environmental design research on educational facilities is at its best a heuristic tool, in that knowledge generated in a present project is used to improve future work.

Most of the research uncovered on educational environments in environmental design research concentrates on the relationship between the physical environment and the organization.

3.3.1 Environmental Design Research: Personal/Organizational Dimension Interactions

Research on the personal/organizational relationship does not exist in the environmental design research literature.

3.3.2 Environmental Design Research: Personal/Physical Dimension Interactions

Work conducted in the area of individual/ physical setting relationships in environmental design research has been observational and non-empirical in nature. Work, when done in this area, attempts to identify salient features of the relationship between person and environment in an attempt to communicate to education planners and designers the problems and opportunities of designing educational facilities.

In one study, Hathway (1988) describes attributes of educational facilities that influence occupants' performance such as physical factors, task-related factors, user-friendliness, organizational qualities; convey subtle messages such as design statements, accessibility, spatial factors and aesthetics; and influence programs and their delivery such as technology and learning-style factors. The identification of these factors could serve to formulate a future research agenda. Much of his evidence is anecdotal and not connected to empirical research, but is commonly held to be true by educators (Earthman, 1986).

Taylor & Vlastos (1975) emphasize the need for a variety of scale and level, the indoor and outdoor environment as part of the learning experience, enriched environments for cognitive development, multisensory learning, guided discovery, and community involvement in education. In the context of school yard play Moore (David & Wright, 1975) emphasizes the possibility of exploring long neglected areas of intelligence typically ignored by traditional curriculum, such as, cognitive, affective, sensory and psychomotor needs. The author goes on to discuss many ways in which the playground supports the neglected aspects of conventional academic centered curriculum through environmental play.

In another study, Sebba (1986) analyzes the implications of a school's physical environment for children's development. The purpose is to draw the attention of educators to the implications of the physical environment for child development.

3.3.3 Environmental Design Research: Physical/Organizational Dimension Interactions

The majority of issues covered by the environmental design research field focused on the physical/organizational dimension relationships: open classroom design as a response to open programs in education, participatory design as a procedural approach to programming and design, facility programming and design issues, facility evaluation, educational facility case studies, future design trends, and design guidelines and standards.

Open Classrooms.

Educators espousing open education in the early 1960's began to express their needs for open, flexible space. In response, architects began to interprete educational programs as needing flexible, open classrooms with movable furniture and partitions. Much of the research done in this area was the product of direct interaction between designers and educators within the context of individual projects. The results of the early research on open classrooms was gathered initially by Educational Facilities Laboratories, Inc. which acted as a catalyst for experimentation and as a disseminator of knowledge regarding educational facilities (Molloy et. al., 1972; Gross & Murphy, 1968).

Gross and Murphy (1968) developed a series of prototype plans which demonstrated the different ways to create 'flexible space' for pre-primary, primary and secondary schools. Part of the prototype was the notion that different forms of classroom space could be planned side-by-side. Different forms of classrooms might include conventional self-contained classrooms, operable partitions in an open space, and classrooms with no fixed walls or operable partitions but mobile storage units would act as screens and define activity areas. Experimentation with these different prototype classroom models in actual building projects was the way information was gathered on the effectiveness of these new arrangements.

Educational Facility Development Process Issues.

Facility programming has served to identify the connection between educational planning problems and the design of educational facilities. Changing educational requirements have led to many school building design developments in recent years, including technologically sophisticated music and computer rooms, large school kitchens, and Title IX mandated equal facilities available for both sexes (Hill, 1984). Herman (1990) points out the danger in allowing architects, instead of professional educators, to develop educational specifications for schools. This practice usually leads to buildings that do not meet the full needs of teachers and students. The author assumes that if the professional educators construct a set of comprehensive and high quality educational specifications the physical plant will enhance the instructional and support programs. Translation problems from educational programs to design are not covered. In another study, Dierdorff (1989) discusses the development of program specifications for school support services based on incorporating behavioral aspects into design and evaluating costs on a life-cycle basis.

Procedural issues in design have an enormous impact on the final quality of the design. No empirical research has been conducted on the impact of the design process on building performance. Improper translation and communication of the educational specifications to the design of the educational facility, conflicts between owner and architect (Day, 1985), levels of participation allowed and politics (Elliot

and Davis, 1989) have all been found to be critical to the overall quality and performance of the educational facility.

Ahrentzen (1988) reviews a number of design changes which have been made in educational environments in an effort to enrich the learning experience. Non-institutional design amenities such as bright and colorful rooms, textured walls, carpeting, adjustable lighting and cushioned benches have been added to provide some comfort and aesthetics, and combat noise problems within and between classrooms. Concerns about glare and flexibility in artificial lighting have led to new lighting systems layouts. Buildings have been designed to respond to adaptive use over time to accommodate changes in enrollment, use of space, and future expansion of space. Caudill (1978; reported in Ahrentzen, 1988) distinguishes between four types of flexibility: malleable space which can be changed immediately; versatile space which serves many functions; expansible space allowing for ordered growth; and conversable space which adapts to program changes.

Design for the mainstreaming of the handicapped is another important aspect of the changing emphasis in building design. Historically, the handicapped were educated in separate special education programs, away from the mainstream student population. Due to a series of civil lawsuits by parents against certain school districts for denial of equal protection of the handicapped, changes were made within the school system to mainstream the handicapped. Design requirements have subsequently been outlined by the American National Standards Institution (ANSI) (reviewed in Ahrentzen, 1988) and since mandated by law (e.g., Americans With Disabilities Act of 1992).

Participatory Design

James Holt of CRS (David & Wright, 1975) advocates involvement of potential users in planning of new school buildings, which include teachers, superintendents, county commissioners, as well as, parents, community residents and students, noting that collaboration will result in better buildings and more responsive educational programs. He suggests that changes in educational philosophy will require not only new forms of educational facilties, but new methods responsive to the changing constituencies. Taylor & Vlastos (1975) go one step further in outlining an alternative design process which includes behavioral observation of children.

Environmental Management

Green (as reported in David & Wright, 1975) introduces the need to recognize that as educational needs change, environmental settings need to change to eliminate mismatches between instructional needs and spatial limitations. He suggests this mismatch can only be rectified through simple diagnosis and adjustment such as regrouping furniture, reassigning space, introducing spaces which afford privacy, decreasing lighting levels, improving graphics and signs. In addition, an ongoing program of environmental assessment and administrative mechanisms to implement required changes is necessary.

Evaluation

Facility evaluation is the most empirically based research available in environmental design research. The importance of obtaining data on the effect of a facility on its users is clear (Earthman,1985). In an effort to standardize the evaluation of educational facilities, a guide has been recently developed (Hawkins & Lilley, 1986) which provides evaluative criteria for school administrators or community leaders to measure the quality of a school's facilities for general condition and suitability for

educational programs. Over 125 items affecting the functioning of a school are covered including school site, structural and mechanical features, plant maintainability, school building safety, educational adequacy, barrier-freeness and asbestos.

Case Studies

The case study approach to generating knowledge about educational environments has its origins in studies on experimental projects. Molloy et al. (1972) offer a perspective on the pioneering efforts of the Educational Facilities Laboratory, and the Experimental Schools Program of the U.S. Office of Education introduced by the federal government, to bridge the gap between basic educational research and its actual practice in schools in the late 1960's. The goal was to fund a small number of pilot projects and to follow through with evaluations. The book provides a series of case studies organized by the following issues: existing space, modernization, open plan schools, furnishings, and the changing community/school relationships. For example, discussion of the value (cost and time savings) of finding and obtaining existing space and adapting it to fit school program requirements is illustrated with several examples of actual projects. The argument for making a distinction between rehabilitation and modernization is then presented and again illustrated with case studies.

Brubaker (1991) describes the demographic changes and the obsolescence of many existing school buildings which have led to an all-time high in the construction of educational facilities in 1989. Ramsey and Rydeen (1989) report on the flexibility built into Fernbrook Elementary School in Maple Grove, Minnesota. Interior walls can be torn down or moved around to accommodate future changes. The prototype design is expected to be used for at least four additional schools. Another case study, Ficklen (1988) describes an elementary school building in Dublin, Ohio, which has developed a 13- acre school-in-a-park shared with the community. On evenings and weekends, area residents have access to the school's activities area for a self-contained community center.

Case studies can also focus on specific design features. Estes (1984) reports on a school district found that indirect lighting fixtures combined with skylights lower energy bills and provide softer, more natural lighting. The principal feels that softer light may have a calming effect on students' behavior. This article is a good example of the level of information being communicated to educational administrators and planners: experiential knowledge communicated without empirical support. It could be argued that the case study is the most tangable form of packaged knowledge; one which is understandable and usable by both educational facility planners and designers.

Non-Classroom Learning Settings

Although not directly architectural in nature, the notion of field visits opens up a whole range of possible environmental design interventions. Robert Sommer and Franklin Becker (as reported in David & Wright, 1975) discuss the myth of contemporary education that most learning takes place in the classroom, and that it depends on the physical presence of the teacher, textbooks and motivation as well. They distinguish between classroom teaching environments (sit and learn philosophy) and learning environments (exploring novel environments). They discuss the educational philosophy of the Montessori schools in conceptualizing the role of the teacher as environmental manager and guide. The authors discuss the notion of school

as a process of learning which can include field visits to a marine laboratory, a workshop in human relations at a mountain retreat, or a mental institution. Although, the authors worked with college students, the implications for field visits for elementary school children is analogous. One example of how the concept of field visits could be addressed by environmental designers might include site selection within a geographical area which offers a variety of other potential learning settings to visit.

School Playyards.
Robin Moore (reported in David & Wright, 1975) discusses the various advantages of utilizing school play yards as places of learning outside the classroom setting. The author discusses the designing school playgrounds to act as social mediators between different children.

Environmental Awareness.
Thomas G. David (David & Wright, 1975) discusses the environmental awareness movement as a need to make a larger audience sensitive and aware of the effects of the built environment on human behavior. He outlines four specific types of awareness: ecological, behavioral, sensory and consumer. The author advances a proposal to make environmental literacy a part of school curriculum. Taylor & Vlastos (1975) raise several issues concerning the use of curriculum as a design determinant when planning educational facilities. They argue that design determinants for school planners should not only include functional needs, but curricular needs as well. Architecture, they argue, can teach and the built environment should reflect what is being learned. The teacher should be trained to perceive the environment as part of the learning process, not just as furnishing and equipment and walls. The meanings afforded by the environmental setting can have a positive impact on learning. The authors include numerous examples of how space can be used to support the teaching curriculum.

Community Schools
Alan Green of Educational Facilities Laboratories (as reported in David & Wright, 1975) explains that due to declining enrollments of the late 1970's, the idea of using the school facilities for other purposes became an attractive idea. The school could act as a community-shared facility for such diverse social service functions as a day care center, a community library, day programs for the elderly and special education, job training, health programs, etc. The goal of a community school is achieved through cooperation with outside agencies in planning, financing and managing a multipurpose facility, with the objective to reintegrate the social services of a community while providing greater efficiency of capital use by sharing space, overhead and personnel.

Molloy and associates (1972) discuss the community and school relationship in connection with social services and recreation, senior citizen entertainment, community theatre and the compelling reasons for economic cooperation, and community involvement in planning of educational facilities. Other concepts are discussed such as reachout schools, home base schools and resource centers which take the community/school paradigm one step further where students move into the community and take advantage of the assets and facilities for learning within the community at large. Finally, the authors present an appropriate planning process for the design of these new educational facility types.

Future Design Trends

In order to design state of the art facilities, environmental designers have to keep informed of the continual changes in technological support for education. Brubaker (1988) describes 21 design trends that will shape the future appearance of schools incorporating both high-tech and postmodern components. The author outlines changes in educational program concepts, issues of flexibility, the idea of great spaces to break up the dullness of standardized spaces, innovative building materials, energy conservation, career education centers, child-care centers, expanded continuing education programs, community schools, year-round schools, recycling buildings, designing for reuse, prototype schools. Gaylaird (1989) describes ten trends for future educational design: correlation between environment and program, technology, communications, flexibility, community pride, participatory design, teachers as professionals, extended use, learning styles and fine arts.

In summary, environmental designers and researchers continue to solve problems with the only knowledge they have at hand, whether it be through personal experience, anecdotal evidence, case studies or previous building evaluations. The most recent developments in environmental design research, programming and building evaluations, have provided the only avenue for potential empirical work to inform the practice of designing educational environments. Design guides have been developed as a means of communicating tried and true ways of accommodating general behavior patterns.

The literature has dealt with such broad issues as practical planning and design process considerations, evaulation studies and interaction of educational design with educational philosophy. However, the strengths of the wide scope of environmental design literature are also its shortcomings. Many issues are raised and discussed, but few are followed through to generate a general knowledge-base for other facilities to utilize. This is not to say however that the lack of general information prevents educational planners from 're-thinking' their schools. The case study nature of the literature helps to provide new perspectives on educational design and helps reframe questions concerning what an educational environment could or should be. In this sense, it is valuable knowledge which can be used by educational planners. Unfortunately, the information is not always easily intergrated to serve the wider audience of community leaders and educational administrators.

3.4 CONCLUSIONS

From this review it is apparent that the three fields rarely share common research interests, yet all three disciplines investigated key linkages necessary for a fuller understanding of the school environment. The result of these seemingly isolated research agendas is a lack of coherency in the study of educational environments. This lack of clarity in research direction is noted by proponents from several disciplines (McKee & Witt 1990., Weinstein 1979, McGuffey 1986,).

From the analysis of findings across disciplines the differences begin to evolve. Educational psychologists have been primarily interested in how the organizational dimension affects student academic achievement and performance. Environmental psychologists have been more concerned with the interplay between children and teachers with each other within the context of the physical environment.

Environmental design researchers concern themselves with issues related to the interaction between the physical and the organizational dimensions which impact the setting. There are clear boundries which have been staked out by each discipline. Why has this finding emerged?

One argument for the identification of these boundaries might be that when a researcher attempts to conceptualize the educational environment, one dimension is chosen as a departure point for discussion, giving the appearance that other dimensions are of less significance. For example, the nature of the personal/physical dimension interaction requires a focus on child behavior. Environmental design researchers, although concerned with child behavior, focus on physical dimension issues, and therefore, emphasize aspects of child behavior much less. It may be possible, that after a time, the other dimensions fall out-of-awareness in the minds of the researcher, and the dimension the researcher is working in becomes his primary means of conceptualizing problems.

A second possible argument is that for each multidimensional interaction a different approach is required, therefore, different fields emerge to study those dimensions. It may be true that although the interactions between personal, social, organizational and physical dimensions of the educational environment can be seen as a whole system, certain levels of structure are implicit in the framework which demand different approaches. For example, how can the problem of creating a new educational facility be solved? An understanding of the relationships between all dimensions is required, but the only dimension which can help specify how to create the entire setting is the one which is first entered through the physical dimension and establishes links to the social and organizational dimensions. The higher-order problem is the physical/organizational link (the general configuration of the physical environment in relation to the organizational goals). Once that problem is solved, then the second problem of the physical dimension link to personal and social dimensions (e.g. individual student and teacher behavior) can take place.

Of all the issues dealt with in the analysis, only the open education/open classroom issue seemed to not only cross disciplines, but also implicate all four dimensions. Of all of the research issues identified, the traditional/open classroom issue appears to be a higher-leveled issue encompasing all other issues. In other words, traditional/open classrooms can be analyzed according to environmental determinants such as noise, density issues, teacher-child interactions, design issues and educational programs.

Th subsequent section will continue to look at the three disciplines from the perpsective of what role they each played in the development of the open education/open classroom concept, and how an historic analysis can help provide some insights into how these three disciplines could be integrated into a larger multidisciplinary approach.

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Chapter 4

REVISITING OPEN SPACE SCHOOLS: A SYNTHESIS OF THREE DISCIPLINARY PERSPECTIVES

"In all our work it has been impossible to ignore the differences between what people said they were doing and what we saw them doing."
Maxine Wolfe, 1986

While the previous section emphasized the differences between these disciplines, this section will discuss similarities and linkages which exist between these disciplines. In addition, suggestions for the possibilities of an alignment of research agendas between the three disciplines. Although each discipline has differing epistemological positions and methodological approaches, the potentials of dovetailing research agendas in an effort to advance the state of knowledge about educational environments are great.

The goal of this chapter is to get at not only what is known about educational environments, but to gain an indication of how this research has impacted the operation of actual educational settings. To get lost in the research findings is to miss the point. One problem with all the research, in all three disciplines is the lack of discussion of actual impact upon the real conditions of schooling. Very little research has been conducted on the influence or efficacy of the research on changing organizational policy toward educational environments. In discussing changes in educational environment, Wolfe (1986) reflects on her experience with research in institutional settings: " We found that in most of these settings what occured on a daily basis *did not reflect the goals that teachers, administrators or designers said they were trying to achieve*. People talked about the value of individualized programs yet taught group classes and measured progress using standardized tests. Though the fixed desks and seats had been replaced by movable furniture, in most rooms and schools no matter what the educational philosophy or the overall design of the space, the arrangements set at the beginning of the school year remained until the last day of classes, including the flexible walls. This was true despite the repeated declarations of staff that their spaces and rooms "weren't working" or that they wanted them to reflect changing programs. In all our work it has been impossible to ignore the differences between what people said they were doing and what we saw them doing" (Wolfe 1986, 1).

The experiences of Wolfe can be seen as a part of the uncertainty of the a real educational setting which is not always reflected in empirical research. Is environmental design research as a form of action research 'good enough' to influence change? Is empirical research in educational environments as conducted misplaced precision?, or is it more successfully a tool for identifying salient features of the environment for environmental designers? These are the types of questions which need to be addressed in an attempt to integrate the three disciplines.

As a way of studying the nature of interaction between the three disciplines, the open classroom/open education historical case study will be reviewed. By reviewing the case history of open education and open classrooms, many of these questions can be addressed.

4.1 OPEN CLASSROOM/OPEN EDUCATION

Of all the issues dealt with in the analysis, only the open education/ open classroom issue seemed to not only cross disciplines, but also find its way into all three sub-systems. Of all of the research issues identified, the traditional/open classroom issue appears to be a higher-leveled issue encompassing all other issues. In other words, traditional/open classrooms can be analyzed according to environment-behavior issues such as noise, density issues, teacher-child interactions, design issues and educational programs.

This section will look at the three disciplines from the perspective of what role they each played in the development of the open education/open classroom concept, and how an historical analysis can help provide some insights into how these three disciplines could be integrated into a multidisciplinary approach.

Even though the movement in open classroom/open education has long ended, and the conservative 'back-to-basics" approach is now in vogue, there have been some calls for reconsidering the validity of the underlying goals which comprised the philosophy of open education (Rothenberg 1989). Many school buildings constructed according to the open schooling philosophy are nearing their 20th year of operation. Some schools have undoubtedly undergone alterations in layout, as well as renovations and additions. The variety of plans and programs can still be observed: many of these schools have reverted back to more traditional programs, others remain alternative, still others retain elements of both traditional and open. Although the movement is past, the issues are still being discussed and are relevant to researchers today.

A Brief History of Open Education/Open Classrooms

The origins of open education began in the mid-1960s with American educators' interest in the English "infant" (elementary) schools and their use of what they called "informal education" (Rothenberg 1989). Informal education, along with what was called the "integrated day," had evolved in England for some time and had its origins in the unique situation facing teachers in London during and after WWII. During the war, many children had been evacuated to the countryside to protect them from the bombing raids. Schooling continued with students of all ages living with their teachers. After the war, the London schools found themselves faced with children of different ages with different levels of academic achievement due to differences in educational opportunities during the war. The educators developed a organization of teaching to students of diverse achievement levels within one classroom. In addition, from experiences with teaching children during the war, teachers were convinced that education was strengthened when different aspects of the curriculum were integrated and related to ongoing daily activities. Information was integrated by relating it to different topics, rather than segmenting the topics into isolated time periods.

During the 1960s in the U.S., challenges to traditional education forced a radical change in educational philosophy. Educational reform movements favored a teaching model adopted from the British informal education model. As a result, open education, and its complementary physical counterpart, the open classroom, were soon espoused (Barth, 1972; Kohl, 1969; Gross & Murphy, 1968). Open education, it was argued, provided more educational opportunities for children, provided freedom and autonomy for self-directed study, required less guidance by the teacher, and helped foster self-responsibility on the part of the student. In terms of architectural

interventions, the open space classroom was a milestone in the history of classroom design which had traditionally been popularly characterized by the 'egg-crate' plan. Architects initially sold school districts on open classrooms for cost benefits, only later realizing the more fundamental connections to open education. Once this connection was made, it became yet another selling point for the profession. It has been reported that as much as fifty percent of all schools built between 1967 and 1970 were open space design. By the mid-1970s, problems with open classroom schools began to spread to districts considering the idea. By the end of the 1970s, many school distict building programs returned to more traditional building designs.

Some Reasons for the Failure of Open Education/Classrooms

The Definition of Open

The problem of what constituted open education and open classrooms became a stumbling block very early in the educational reform process for proponents, educational administrators, researchers and designers alike. No clear relationship has ever been presented between open education and the need for open classrooms. As far as some educators were concerned, open education could be accommodated in traditional classrooms, but this option was rarely explored. Once the open education philosophy took hold, so in turn did the construction of open classrooms. It could be argued that at times the reverse scenario occurred; open classrooms were constructed with the thought that open education would follow. This scenario constituted a naive environmental determinism: that the physical environment can determine behavior.

The ambiguity of openness was never resolved satisfactorily. For example, the definition of what was considered "open" varied from teacher to teacher. Some used open to refer to certain informal teaching techniques, while others described their classrooms as open when they individualized the way they taught certain subjects. Due to the increased demands and stresses of teaching in an open classroom setting, many teachers reverted back to their traditional programs while often still believing they were teaching open education simply because they were in an open classroom. In addition, educational program policy concerning openness varied in its effectiveness.

To complicate matters, the literal interpretation of the word "open" led architects to design buildings which had no walls between classrooms. The conceptual link of open classroom to open education could not be a clearer example of the organizational/physical dimension linkage emphasized by environmental design research. It could be argued that the open classroom design concept (of no walls between classrooms) became the most damaging factor to the open education movement. In many instances teachers using open classrooms continued to use traditional teaching methods unwilling to change their educational philosophy required by open education. As a result teachers were unable to adapt to the noise and distraction the open classroom setting allowed.

Finally, the research conducted on open classrooms has had numerous methodological problems. The most serious problem has been one of definition for the word "open" and the degree of "openness" (Marshall, 1981). With different definitions of openness it becomes difficult to reliably compare across studies and make clear conclusions about what affects are caused by what type of open classroom. Ross & Gump (1978) have offered a way of measuring designed and modified openness in elementary school buildings, but there is no evidence that this

system of measurement has been used by any researchers other than themselves. It is also interesting to note that this measure was developed a full ten years after the open school construction boom; too late to influence the research in any meaningful way.

Impact of Educational Policy

The impact of the educational policy of open education on classroom teaching methods employed by teachers is ambiguous. It appears that some teachers continued to use traditional teaching methods despite administrative policy to the contrary. Was it the case that some teachers may not have appreciated changing their teaching styles mid-way through their careers? Was it a matter of teachers not completely understanding the new open education philosophy? Or was it simply a lack of administrative leadership in effectively training teachers in this new method of teaching? These questions have only begun to be answered in the literature.

For example, some researchers (Good and Biddle, 1988) believe that educational reform often fell into the trap of creating open classrooms, developing learning centers and new individualized instructional materials at the expense of understanding how to mobilize students to use these materials as they planned. The aspects of group behavior in a new open classroom environment were ignored, as well as necessary monitoring of student progress in basic skills.

What may have been one of the most critical mistakes of school administrators in moving towards open education was the assumption that there was no need for organizational development, personnel changes or in-service training programs. Many times educational program changes were imposed by outsiders without community participation and support and often in these cases successful implementation of these programs were doomed from the beginning. Administrators did not always take into account the possibility of community group opposition. This was the case with two schools with low-income families who felt their children were not being taught the basic skills (Barth, 1972). In general, parents in urban communities more often supported "back-to-basics" reform rather than open education (Rothenberg, 1989).

Impact of Educational Research

The research literature, although inconclusive about the relative merits of open education, seems to have been, in part, instrumental in downfall of the political undoing of the movement. The disadvantages of open education/classroom quickly leveled against proponents, suggested that students waste time moving from activity to activity, less time is focused on educational tasks, students are distracted by other activities going on around them, and teachers experienced increased levels of noise which decreased their effectiveness. Another disadvantage was the mixed result of academic achievement comparisons between traditional and open classroom settings.

It is generally believed that the research literature which reported the failure of open classrooms to measurably increase achievement scores compared to traditional was a strong contributing factor in the demise of open education (Raywid, 1981). Many non-achievement outcomes such as cooperative behavior among peers, independence in work habits, attitudes and creativity were clearly achieved within the confounds of the open classroom (Giaconia & Hedges 1982), but failed to persuade the public at large to retain open education and classrooms.

4.2 THE ROLES OF THE THREE DISCIPLINES IN OPEN EDUCATION/OPEN CLASSROOMS

In exploring the roles each discipline played in the development of the open classroom/ open education movement, there is a clear pattern which emerges. The move toward open education was first initiated by educators who took the lead from English informal education. Environmental designers following the assumptions of the educators provided a physical setting (open classroom) which was presumed to match the objectives of open education. Finally, environmental psychology and educational psychology followed up with empirical research of the open classroom setting. The open classroom essentially became a working research laboratory. Many of the assumptions of open education were not challenged by researchers other than the comparison studies between traditional and open classrooms.

The movement towards open education was a political decision made by the educational community based on changes in the educational philosophy of the period. The move toward constructing open classrooms on a large scale began before any substantial research had been completed to support the open education and open classroom hypotheses. Once the research began to indicate some differences (mainly inconclusive evidence in both directions), the life of open education was already waning. Whether or not the research had much effect on the short life of open education, it is unclear, since as stated above, research findings were used by proponents and opponents alike. What does seem to be clear, however, is that direct conflicts between educators, parents and the general public over the viability and efficacy of open education were the main contributors in determining the final outcome of the movement (as Gold & Miles, 1981 illustrate). Could research have played a more prominent role in the processhad it been utilized candidly in the process of developing the concepts of open education? Could findings from preliminary projects have helped clarify what an open classroom should look like? The idealistic answer to both these questions is yes.

4.3 THE CASE OF THE LINCOLN ACRES SCHOOL

Gold and Miles (1981), in a book called *Whose School is it Anyway?: Parent-Teacher Conflict over an Innovative School* discuss the problems connected with creating a new school from the ground up from an ethnographic perspective. Although this more sociological view has not been covered within this publication, there seem to be many lessons and implications that could be drawn from this case study to further the cause of synthesizing research agendas of the three disciplines.

Lincoln Acres was one of six sites in what Gold and Miles called their "Social Architecture" study. The story is told of the planning, construction and occupancy of a new open-space elementary school, and the conflict that existed between the community and the school in that process. The early planning and vision that emerged, the formulation of the faculty, and the intensive "final planning" that took place during the months before the school was to open are described. A description of the gradual development of conflict between the school and its surrounding community during the school's opening, and the subsequent reorganization of the school in response to the conflict between educators and parents during the first and second years of the school opening is presented (Gold & Miles, 1981; 11).

Over the course of the school's initial year, the school changed from a 'quasi-collegial organization' (child centered individualized instruction) to a 'legal-rational bureaucracy' (modified back-to-basics program of study). Basic changes in organizational structure were a result of redefinitions of educational philosophy offered by the school which were for the most part a result of the conflict between school educators and the community (Gold & Miles, 1981; 345). Organizational change was the result of educators' inabilities to maintain positive relations with the community. Gold and Miles conclude by introducing several required factors which would have assisted educators, in guiding organizational change in a more positive manner: rates of change, levels of organizational rigidity, the exercise of power, leadership, and organizational fragility.

There are many illustrations of instances where community group action has limited and framed personal and organizational dimension issues. In fact, it could be argued that a whole body of knowledge about school environments covered under the rubric of "sociology of education" have been missing from the discussion thus far. One blaring observation of this case study is the almost complete lack of reference to the physical environment of the school itself. This observation lends further support to the argument that separate fields of research consistently limit their coverage of other aspects of the total educational environment. Nevertheless, the inclusion of a discussion of social issues will begin to reveal that certain issues within the three disciplines may be more critical and relevant for research than others.

4.4 CONCLUSIONS

The case history of open education, and the open classroom, brings to light several issues which can help refine the multidimensional model of the educational environment, as well as provide a framework which begins to suggest a conceptual synthesis of the three disciplines of educational psychology, environmental psychology and environmental design research.

Internal factors , as well as external factors to the educational environment contributed to debate on educational philosophy during the sixties reform movement. The resulting open classroom/alternatives schools, a first in the history of education in the U.S., raised many fundamental questions of educational philosophy previously not open for public discourse: for the first time, the public had a voice in how they were to be educated. Community participation was a very real factor in the success or failure of open education (Barth 1972, Gold & Miles 1981). In fact, parental involvement in school activities became a central feature of the "new" educational philosophy.

The problems in dealing with the political groups within and outside of the open education movement were not taken into account either from the side of school administrators, or on the side of researchers in any of the three fields. The relationships between administrators and teachers, and parents and teachers were not researched as part of the larger theoretical framework of open education, even though participation was one of the originally espoused principles of open education. Research focused, in the case of the psychologists, on the children and possibly the relationship between the teacher and the students, but only from the viewpoint of the individual, not the group. In reality, educational policy impacted groups as well as individual behavior.

Several issues have been cross-linked from the perspective of the multidimensional model of educational environments: lessons of open education, and questions concerning educational policy. Each issue will be discussed in turn, followed by an exploration of directions for future research.

The Experience of Open Education

Open education was first and foremost an educational philosophy developed out of social unrest of the sixties. How the philosophy of open education was implemented was not the same from city to city, school district to school district, or even classroom to classroom. This diversity of definitions establishing what constituted open education and open classroom was never clearly addressed. Researchers and designers accepted almost without question the assumptions of this new philosophy. Researchers and designers will need to become much more explicit about their values and hidden agendas during the present and future reform movements, and take a closer look at how their work fits into the ever transforming forms of the educational system.

Educational Policy

From the perspective of the open education/classroom case study, the strength of the linkage between educational policy and teacher curriculum has not been clearly explored. How much control does administration have, or expect to have, on teacher instruction methods? How can school administrators both encourage diversity in teaching methods, and at the same time provide the most congruent physical environment for learning? It has been demonstrated by many researchers that teachers do not have the training to manipulate the physical classroom setting to support their own teaching styles and methods. In what ways can educational policy contribute to the education of teachers to the possibilities of using the physical environment to support their teaching efforts? Many problems of classroom management can be attributed to weak, or unclear educational policies concerning both teaching methods and use of the classroom setting.

Directions for Future Research

Several areas of research have been identified for future work, and can be approached from any of the three disciplines.

1. *Research on the impacts of differing levels of quality of instruction on usage of instructional space is needed.* Previous research on the impacts of open or conventional classroom space on student achievement scores has left out the mediating variable of teacher effectiveness. A measure of the quality of instruction might be one way of getting a more accurate reading of the influences of space on achievement. Other measures, such as how the teacher actually goes about using classroom space during instruction, and comparing use across classroom settings, might begin to develop a more comprehensive approach to the study of classroom settings in use.

2. *Continue research on the role that groups play in influencing organizational policy and the effects of this action on the educational setting.* Issues of organizational development might be addressed to understand how changes in organizational structure could influence design and use of instructional space.

3. *Create a more sophisticated outcome topology of degrees of classroom openness with respect to instructional methods.* Which methods work best in which degrees of openness? Openness can be defined as a continuum ranging from highly open education to highly closed (traditional) education; and thus can be defined on a continuum of open to traditional physical classroom settings. All dimensions of openness need to be clearly defined.

4. *Continued research needs to take into consideration the combined social and physical environmental dimensions on the student's performance.* Research on student achievement will always be a central feature of the evaluative processes of the educational environment, however, the student may perform better in some social environments than others. What these optimal environments might be should be researched. In the meantime, student behavior and academic performance should be evaluated within the context of the larger social group characteristics. As one teacher stated, "the teaching profession is now 85% social work." Research should address this reality.

5. *The role of the physical environment in supporting philosophically diverse educational programs is unclear and should be investigated.* Programs which could be investigated range from various alternative and magnet schools (e.g., creative arts, language immersion, Montessori, Urban Waldorf), to special school programs (e.g., at-risk students, emotionally disturbed, over-age middle school students, bilingual-bicultural education, programs for academically talented). In what ways do these different programs require similar or different physical surroundings, and how can the physical environment best support the program in question?

The brief list developed above attempts to identify areas of research which could be a common concern of all three disciplines (educational psychology, environmental psychology, and environmental design research). Hopefully, some of these areas of research will be of interest to administrators and citizens outside of the research community, resulting in effective social change.

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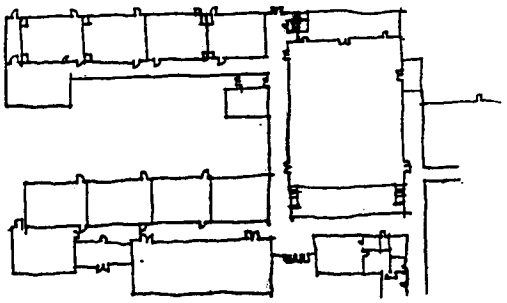
Chapter 5
CURRENT EDUCATIONAL FACILITY PLANNING MODELS: A CRITIQUE AND RECONCEPTUALIZATION



"...state legislatures, regulatory agencies and product manufacturers have had more effect on school design and equipment than educators themselves." Harold Hawkins, The Interface Project, 1990.

This chapter argues that current educational facility planning models in the architectural and educational literature are at most, partially successful in their aim of guiding educational planners through the facility planning process. In addition, they fail to provide a comprehensive accounting of the social, economic and political realities of either the circumstances surrounding the planning effort or the nature of the educational system. By not completely representing these realities, planning models leave educational administrators acting on the basis of simplified and incorrect assumptions about the nature of the process. As a result, administrative decisionmakers are ill-prepared to deal with the inevitable political conflicts and miscommunication. As a result, facilities are often under-funded; projects are inefficiently designed, not taking user needs into full consideration; and once facilities are occupied, they are often haphazardly and hastily staffed, allowing problems to fester throughout the life of the building. Given the increasing pace of current school reform and change in the educational system, new conceptualizations of the facility planning process are greatly needed in order to successfully guide educational organizations in their efforts to accommodate this change.

The focus directs itself to the earlier stages of the facility development process[6], that of feasibility and planning. Issues covered during these phases in the process have the greatest impact and influence on the nature and quality of the subsequent stages in the process and therefore, deserve special attention. An existing model of the educational facility planning process will be reviewed followed by a critique of the model. A reconceptualization of the planning model is then developed which addresses the issues raised in the critique, and finally, some conclusions are offered.

5.1 THE EDUCATIONAL FACILITY PLANNING PROCESS: CURRENT MODELS

Current models of the educational facility planning process are based on the practical experiences of educational planning and design professionals and on their notions of how the process should be structured and organized (Graves, 1993; Vasilakis, 1990; Ingalls, 1986) (See Figure 5.1). Educational facilities master planning has been defined as "a process to determine the educational needs of a school district and the facilities needed to support those educational needs, both now and in the future" (Vasilakis, 1990; 26). The process allows a school district to examine its educational

[6]The educational facility development process as defined here includes the sub-processes of feasibility, planning, programming, design, construction, occupancy, facility management (operations & maintenance), post-occupancy evaluation, and redesign.

goals and philosophies, educational teaching methods and its facility resources and needs, as well as allowing the district to explore alternative solutions.

It is generally agreed that planning of school facilities should be done within the framework of a well-developed, long-range construction and educational program plan. This is determined by a thorough study of, among other factors, community services; financial ability and economic base of the community; construction priorities; enrollment and population trends and projections; and the nature of the educational programs to be housed. Such advanced planning, it is argued, can eliminate costly errors in construction and minimize the intervals between the need for and acquisition of necessary physical facilities (Ingalls, 1986).

The most complete and current descriptive model of the educational facility process has been documented by Ben Graves (1993; 183-210), a former project director at Educational Facilities Laboratories (EFL). He describes the process in terms of the roles and responsibilities of the architect and school administrator in planning and designing the school. The model offers a cogent summary of acceptable educational facility planning practice conducted over the last 30 years in school districts across the country.

Graves first reviews the Educational Facilities Laboratory's seven stages needed to plan a building project: (1) *get started*: defining goals and planning to plan; (2) *gather information*: enrollment projections, capacity and utilization analysis of existing facilities; (3) *identify priority needs* : review the information-base and involving the community; (4) *define program requirements*: attention to physical needs and preparation of educational specifications; (5) *explore options:* be consistent with the community's educational goals; (6) *refine the plan*: determine feasibility, cost and phasing; and (7) *follow through*: presentation of plan by experts to the community for approval.

Special emphasis is given to the effective uses of the educational consultant, writing of comprehensive educational specifications, selection of the architect, working with school boards, learning the community perspective and understanding the child's perspective. In addition, Graves stresses the importance of the effects of technology on school design, as well as furniture and equipment, modernization, specialized spaces and security issues.

Graves also presents the stages of the conventional architectural design process that follow the educational planning process: pre-design planning or programming, schematic design, design development, construction document preparation, bidding and construction. He completes his description of the educational facility planning process by outlining seven characteristics which successful planning processes have in common: (1) they have a clearly stated program, (2) there is a give and take from participant "experts" in the process, (3) plenty of time is taken for planning, (4) involvement of community in the planning process is promoted to gain acceptance and support for the project, (5) training sessions on the use of the building are implemented, (6) post-occupancy evaluations are conducted, and (7) maintenance and repair of facilities are regularly completed as part of a long-term maintenance program.

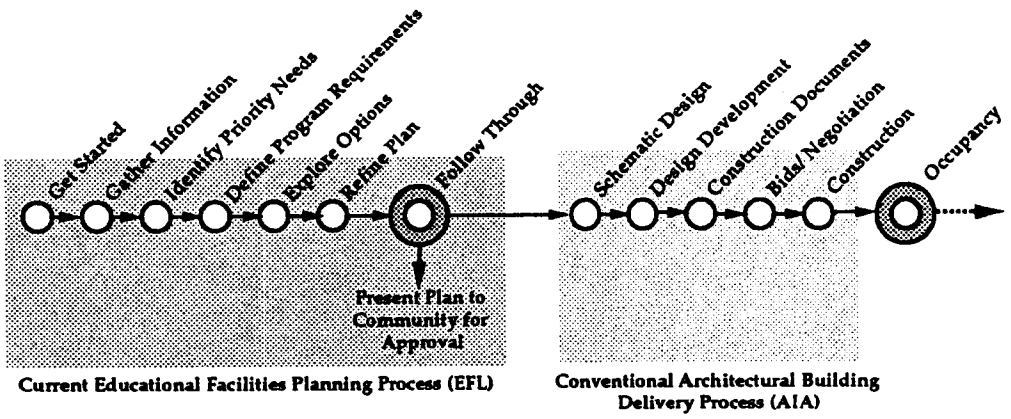


Figure 5.1 Educational Facilities Planning Model
(Adopted from Graves, 1993)

In general, the purpose of this model is to represent the most critical elements or components of the facility planning process. The argument presented in the following pages is that the current educational facility planning model summarized above, does not fully capture the reality of the planning process, and thereby is not as effective as it could be in guiding educational administrators and planning consultants through the process.

5.2 THE CURRENT MODEL: A CRITIQUE

The current planning model as described by Graves (1993) is by its very nature normative, and espouses the rationalistic tradition in planning theory. The model is normative in that it presents how the planning process *should be*, not *how it is*. It is a rational model in that it views people as a utility and defines human relations in instrumental terms, and it assumes a sequential, observable cycle that includes setting goals, determining objectives, making plans, implementing the plans, and reviewing the results (Adams, 1991; 7). Admittedly, proponents of the current model might agree that the model describes what should happen in the planning process and that if the procedures set forth are not followed the process could fail. However, if in fact the goal of this model is to guide administrators through a complex process, why has the current model failed, in many cases, to guide? By not fully accounting for the social, political and economic realities inherent in the planning process, administrative decisionmakers often abandon and/or ignore the important guidelines in favor of ad hoc planning.

Status of Existing School Infrastructure

One approach to evaluating a process is to analyze the products produced by that process. While everything which has gone wrong in the design and management of educational facilities over the past 30 years cannot be faulted solely on the initial planning process, or the model that it is based on, historical evidence can highlight aspects of the process which could warrant improvement or reconceptualization.

In 1989, the Education Writers' Association released a study of the condition of school buildings which found that 49% of all schools nationwide were built in the 1950 and 1960s, primarily to meet the increasing demand for schools for baby-boom children (as reported by Walker, 1993). Many of these buildings were constructed of cheaper building materials, with flat roofs, and built to last no more than 20 years without some form of major repair. In addition, these buildings have not provided flexible space as claimed by their designers. The study also found that 21% of buildings nationally are more than 50 years old and are located primarily in the inner-cities. These buildings have been neglected and are in need of major repair and renovation due to short-sighted maintenance and repair policies. The most alarming finding of the study was the fact that over 25% of the buildings were considered inadequate for educational use by state facility directors due to serious maintenance and repair needs, environmental hazards, and overcrowding. Close to another 33% of these buildings will be at capacity due to population growth and other educational demands in the near future.

According to the study conducted by the Education Writers' Association, the U.S. school infrastructure has been virtually ignored for the past two decades due to high, ongoing investment costs, a declining tax base and declining enrollments. Ironically, school districts over the past several years have been experiencing new growth in enrollments, and in new programs and services such as the year-round school programs, extended school hours of operation, daycare, and provisions for new program requirements in math and science.

The current model of the educational facility planning process may adequately address immediate needs of users, but it clearly has not accounted for such long-term building life-cycle issues as repair and maintenance policies and changes in use of facilities due to educational program changes. The plans which called for flexible space planning and design have not proven to be as effective in addressing these program changes as was once assumed.

Collaboration and School Reform

The current model of the educational facility process was originally developed during the dramatic educational system reforms of the 1960s in which state involvement in school finance and governance expanded to include the planning of facilities. Many educators believe that "state legislatures, regulatory agencies and product manufacturers have had more effect on school design and equipment than educators themselves".[7] Contrary to the current model's call for participation by educators in the planning and design process, few educators have traditionally been involved in a process that has been consistently controlled by architects and by educational administrators and planners, both state and local.

The case of the planning of three new middle schools in the Milwaukee Public Schools (MPS) provides an example of the manner in which "collaboration" is realized in the current facility planning model. As a result of an offer of a development package by a local developer, MPS initiated the planning of two new middle schools to be housed in existing abandoned structures in the city. A relatively comprehensive collaborative planning and design process had been previously completed in the creation of another new middle school. The middle school was

[7]Harold Hawkins, The Interface Project, Texas A&M University, quoted in *Education Week*, February 21, 1990.

considered to be a model implementation of MPS's middle school policy established in 1979. The two new middle schools included in the development package were to be based on the planning concepts derived from this earlier model school. The collaborative planning process was drastically shortened, involving the school board, central administration, affected business community representatives, the architect and the developer. Neither schools' design involved educators or children in the process. In fact, the staff for each school had not even been selected until well into the process. MPS facility planners and architects assumed that planning decisions previously established in an earlier project had universal applicability and that the new school designs required only minimal adaptation even though the siting and configuration of both existing structures were completely different.

Now, with yet another new wave of school reform promising to "restructure" the educational system, the possibility arises of restructuring the conventional planning process to embrace a more collaborative process advocated by the current model. However, according to Goldberg and Bee (1991) little has changed in the process even with the advent of school-based management and shared decision-making.

Politics and the Acquisition of Fiscal Resources

The most severe critique against the current planning model is that it does not take into account the complexities and paramount importance connected with the acquisition of fiscal resources without which the building program can never become a reality. Marshall, Mitchell,& Wirt (1985) found that of seven major policy mechanisms, school finance dominates policy-making while building and facility policy ranks last. State political culture, informal processes, partisan politics, state fiscal environment, and history and tradition seem to be more powerful determinants of facility design and planning decisions than organizational factors.

The findings of Marshall and associates (1985) are consistent with the position taken by Borman and Spring (1984) who argue that educational policies, established by competing self-interests of the public, capitalists, administrators, and teacher unions, are not always in the best interests of the schools or school children. Describing politics at the local level, Borman and Spring maintain that school boards are run by the civic elite, superintendents have little control, and central administrations are bureaucratic and reluctant to facilitate change.

The current model of educational facility planning does not consider the devastating impact of inequities in the system of school financing for poor schools, especially urban districts. Even with massive changes in state involvement in school finance and governance since the 1960s, decision-making and leadership in school building and planning remains a local matter (Walker, 1993). The state has traditionally provided minimal assistance for debt service or building authorities. Even with the increased burden on districts due to age, population growth, and inadequate construction, few states today help equalize the burden.

In a study of decisionmaking in the planning and design of Illinois public school facilities, Westbrook (1988) found that strategies employed by educational administrators to acquire resources were designed to operate successfully within a tacit, assumptive, policymaking world. This knowledge was used to circumvent an established, highly formalized system, substituting a more operative system for the improved anticipation, planning, and provision of adequate educational facilities.

As a result, educational administrators are often more concerned with securing funds for school facilities than making sure the needs of educational programs are met in the building design. Westbrook (1988) found that the articulation between educational goals, objective needs and facility design was more of a concern for architects than it was for superintendents or principals, who seemed to feel their options are highly constrained in this area, possibly due to limited resources and state bureaucratic structures.

The example from the Puyallup (Wash.) School District illustrates the necessity of campaigning for community support when attempting to raise the resources required to implement the facility plan. Puyallup S.D. had twice failed to pass bond issues, but were nevertheless faced with the quandary of looking for solutions to their explosive enrollment growth projections (Berg & Apostle, 1992). The district planned to develop a prototype that would replicate the basic plan of a set of previously successful elementary schools for future elementary school construction. The prototype strategy allowed the school district to reduce planning time, obtain agency approval ahead of time, and demonstrate to the public the district's ability to make prudent use of taxpayer dollars. After two failed bond issues, they created a community partnership, called the Facilities Crisis Task Force, which included representatives from all geographical areas and political groups. In addition, the district set up the Citizen's Committee for Education to collect and disburse campaign funds. As the task force studied the situation, they came to the realization that the crisis was real and urged the district to resubmit and increase the bond issue to twice the original sum. Serendipitously, a teacher union strike a month before the election became a catalyst for directing community attention to the facilities crisis. Along with a massive marketing campaign utilizing all forms of media, solid school board support, and over 900 volunteers organized and trained to elicit support from their families and friends, voters returned to the polls and voted in favor of the bond issue.

The current planning model accounts only for organizational factors such as the composition of the planning team, determining the goals of the school district and the immediate needs of the school. The model does not explicitly address what is the most critical aspect of the planning process: the preeminent position of fiscal and political issues over programmatic issues.

It is clear from these criticisms that the current educational planning model needs to factor more comprehensively in the political realities of fiscal resource acquisition, reconsider the impact of a truly collaborative process which extends school reforms such as shared decisionmaking to the educational facility planning process and also integrate all aspects of the facility development process, such as planning, design, and management into one continuously on-going process.

5.3 RECONCEPTUALIZING THE EDUCATIONAL FACILITY PLANNING PROCESS

"Despite the general acknowledgment that educational systems are soft, which suggests that interactive models would be more efficient, rational models continue to be the planning processes of choice for many educational planners" (Adams, 1991; 15).

The current model of facility planning can be characterized as a rational model in that it assumes the sufficiency and neutrality of objective expert knowledge, is sequential in nature, and that its planning methods have universal applicability requiring only minimal situational adaptation (see Figure 5.1). However, it is clear that educational policy decisionmaking is decidedly political and consensual, both characteristics of what Adams (1991) calls interactive models: models which do not bow to the demands of objectivity and quantification and are characterized by value, belief, power, collaboration, consensus building, conflict and negotiation.

The educational facility planning process can be reconceptualized as containing aspects of both rational and interactive models (see Figure 5.2). Due to the highly value driven aspect of 'what is a good educational environment', a wide base of support, participation and consensus is required to effectively create a facility which meets as many needs as possible within the community and the school.

In addition, obtaining financial resources to secure a building project, requires the support of not only the tax paying community, but the local politicians and the state legislators as well. These processes are political and interactive in nature, not rational.

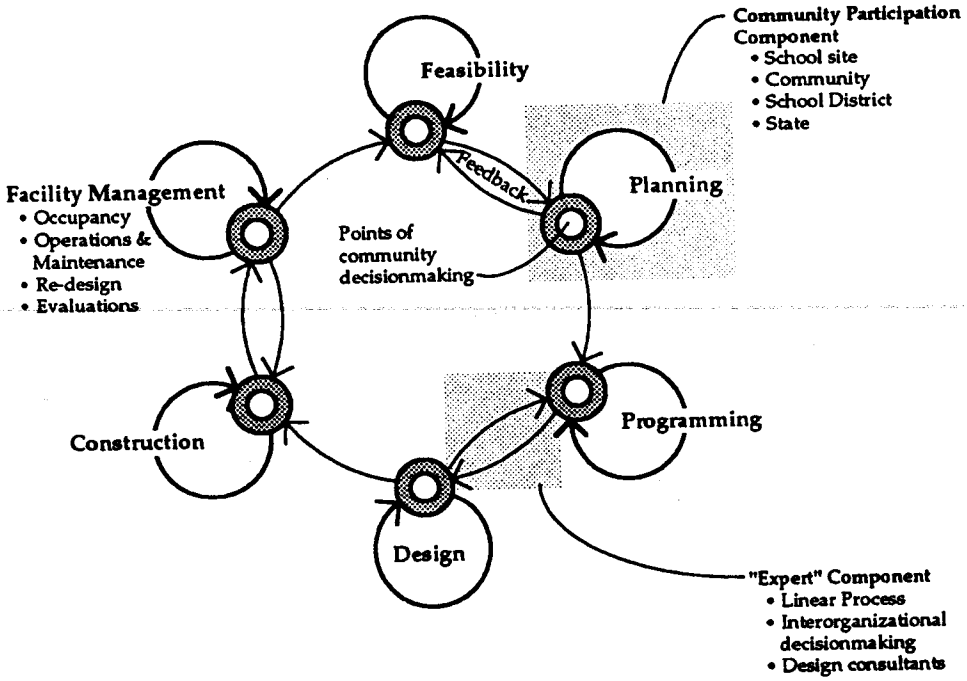


Figure 5.2 Integrated Educational Facilities Development Model

However, once the mission and goals of the school district are established, there are a series of linear, rational steps which must be followed in order to build the actual school building. Within each process -- feasibility, planning, programming, design, construction and on-going facility management -- there are interactive and rational aspects. Each aspect must be recognized as such and integrated.

The integrated educational facilities development model emphasizes the equal importance of the feasibility/planning process, the programming/design/construction process and the facility management process (which includes occupancy, operations and maintenance, evaluation and re-design). The model attempts to indicate the need for on-going management of educational facilities in order to creatively anticipate educational program changes in addition to the traditional repair and maintenance issues. Educational facilities will continue to experience major changes well beyond initial design and construction and this fact must be recognized my school districts nationwide. Decisionmaking can be utilized in all points of the cycle of facility development.

5.4 CONCLUSIONS

It is difficult to know how pervasive the use of the current educational facility planning model is across the country, or what the impact of a more integrated model would be. According to the Education Writers' Association study mentioned above, as of 1989, only 12 states had a statewide facilities plan, and 31 states had only an inventory of buildings. Many states had only one staff member assigned to school facilities planning, while only 17 states provided training for school district staff (Walker, 1993). Facilities have been almost completely ignored by state legislatures with less and less of the budget going towards repair and maintenance, let alone new construction. It is clear that more attention must be placed on facilities, given the enormous problems in the school infrastructure.

Faced with the prospects of a growing educational system, and the prospect of a continued lack of financial resources to modernize the school infrastructure for the next century, the need to reconceptualize the current model of facility planning will be critical to the success of the planning effort. A more interactive model such as the one presented offers to make accessible to a wider audience, the tools for finding more creative, reform-minded solutions to the problems of district growth, and to gain the support of the school board, the community and the taxpaying public.

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Chapter 6
A CONCEPTUAL FRAMEWORK OF EDUCATIONAL ENVIRONMENTS

The previous chapters have described the current state of the art in the research on school facilities and their impact and role on the educational process. They provide a substantive backdrop for presenting a comprehensive model of educational environments. This final chapter focuses on conceptualizing a framework that integrates the disparate research on the educational environment. First, common perceptions of the role of the environment in the educational process are made explicit. Next, precedents in the literature that have attempted to foster this integration are reviewed and critiqued. From this review, the Multi-dimensional Model of Educational Environments (MMEE) is formulated. The chapter closes by discussing the implications of the framework for research and practice.

6.1 THE NEED FOR A COMPREHENSIVE MODEL OF EDUCATIONAL ENVIRONMENTS

Common perceptions of the physical environment

Part of the problem for advocates for change in the planning, design and management of school facilities is the manner in which school facilities have been perceived by the educational community and public-at-large.

Many believe that school buildings constitute no more than *passive* shells for activity -- permanent walls which surround what is important -- teaching and learning. School buildings are rarely perceived as *active* changing settings which contain various levels of support for teaching and learning, from the size and configuration of the room to the placement and arrangement of furniture, equipment, and the various displays within it; in short, the whole physical setting of the classroom. The very fact that identically configured classrooms can take on as many variations in internal arrangement as there are teachers attests to the versatility of the physical setting.

School buildings are often seen independently from the behaviors which take place in them. The mutually supportive *relationship* between the physical setting and student, teacher and administrator behaviors are not recognized. Other than furniture arrangements, teachers are not trained to be cognizant of the way space can support or hinder group dynamics, individual privacy, and/or feelings of crowdedness. Even the territorial boundaries defined by the teacher's desk in relation to students' desks can have a great effect on students' perception of the position of authority of the teacher and thus affect teacher/student relations in intangible ways.

Related to the passive/active dialectic, the building is often conceived solely in terms of a relatively fixed object or *product* which is not amenable to a great deal of change. However, the *process* by which the building is designed, maintained and modified through formal and informal facility management policies, in addition to daily change and modification due to teacher adaptations, has not been recognized as an important factor affecting the effectiveness and efficiency of the educational process.

The physical environment is typically not perceived as influencing educational outcomes even though most people will admit intuitively that it makes a difference -- what kind of difference the environment might make is unknown. The concept that the impact of the physical environment on educational outcomes is *mediated* through the interplay of many intervening behavioral and attitudinal factors is not apparent to many, either inside, or outside the educational community. To illustrate, a building that is well-maintained and comfortalbe will provide a measure of satisfaction that could lead to students doing better on tests. Of course, many other factors would feed into this model, such as teacher ability, differences in student applitude and so on. The mediational concept, however, would suggest that the physical environment may play some role, in this example, *through satisfaction* with building conditions.

Criteria for measuring environmental quality

Misconceptions concerning the role and purpose of school facilities originate from the points-of-view taken by various participants in the planning, design and management process. Each participant group brings with them different perceptions of what constitutes a quality environment for education, as well as criteria for measuring it. Each stakeholder group holds different assumptions about the role of the physical setting in the educational process based on that group's established performance criteria for measuring educational quality.

Educational researchers and policymakers faced with establishing measures of accountability across school systems are concerned with measures of academic achievement as the ultimate indicator of educational quality. Based on this performance criteria, researchers and policymakers have discounted the effects of the physical setting based on the limited evidence linking these effects to academic achievement.

School administrators are faced with the dual need to balance budgetary expenditures and academic achievement in an effort to be accountable to school boards, parents, the local community, the business community, and the general public. Educational quality is measured by its cost effectiveness: deriving the highest achievement from the lowest cost. School administrators must act on their own intuitive experience and knowledge of the physical setting gained through operating educational programs in school buildings. They have little empirical evidence upon which to base their arguments to board members and taxpayers for the need to improve physical conditions of their schools. Administrators must wait for upsurges in demographic trends and crowded conditions before a convincing case can be made and deferred maintenance can be addressed.

Teachers' performance criteria for educational quality in the classroom includes improved skill development, behavior and conduct, and drive and motivation to learn. Academic achievement scores, as measured by standardized tests, typically, but not always, reflect these various performance measures. Many teachers, feeling the pressures and dilemmas of accountability, often teach to the test to ensure high test scores. As a result of these more qualitative measures of performance, teachers are the most apt to see the value of the physical setting in achieving their goals. They are immersed in the physical classroom setting on a daily basis and intuitively modify the space to improve the overall learning environment. Unfortunately, due to the lack of emphasis by administrators and facilities managers to acknowledge these more subtle

attributes of the physical setting, teachers must make due with the limited resources they have in order to create an environment conducive to instruction and learning.

Facility managers have a working knowledge of the environmental control systems of buildings and their immediate effects on teachers and students. Facility managers assess the performance of quality in their work to the level of complaints about the physical plant. However, many times facility managers do not see other aspects of facility management which are just as important as operating and maintaining building systems, such as the importance of the timely response to occupant complaints, the symbolic value of learning in a quality environment and the potential contributions of environmental quality on the overall quality of the educational process.

Design and planning professionals equate 'good design' with quality in the educational environment. Performance criteria conventionally set for obtaining good design include functional and aesthetic design which meets the organizational goals of the school (i.e., scope, educational program, budget, and schedule). Planning and design professionals who have offered the most in terms of creative design solutions and implementation of school facilities planning do so without an adequate understanding of the educational process beyond the level of meeting formal organizational goals and objectives.

The public, broadly defined (society, business, community), is most concerned with the quality of education as a cost effectiveness measure: highest acheivement at the lowest cost to the taxpayer. Education which increases in cost is assumed to be wasteful, especially if achievement does not appear to be competitive with other developed countries. Businesses are especially concerned about the cost effectiveness of the educational system as the "products" of the system constitute the future workforce. In this attempt for cost effectiveness, the physical environment is almost completely ignored with the possible exception of computers in the classroom.

A comprehensive model which integrates these conflicting perceptions and criteria would be practical not only for educational researchers, but also for educational policymakers, school administrators, teachers and staff, design and planning professionals, and the various participants in the local community. A model of the educational environment that clarifies individual and group goals and objectives might provide a vehicle for making explicit each stakeholder's interests and offer alternative directions and solutions that might resolve conflicts.

The following section reviews and critiques some of the approaches in the literature that offer such integrative views of the total educational environment.

6.2 A SURVEY OF ECOLOGICAL MODELS IN THE LITERATURE

Research on educational environments has typically followed a pattern of investigation which has limited the ability of researchers to compose a comprehensive picture of what constitutes a supportive environment for learning. For instance, the educational literature emphasizes organizational and social aspects of the learning environment without mentioning the possible role the physical setting provides in learning. The architectural literature emphasizes physical setting solutions formulated on misconceptions of educational philosophies, as in the case of open classrooms of

the 1960's. Finally, environmental psychology literature focuses primarily on the psychological responses to specific environmental features researched in isolation to other physical setting factors, and often at the expense of social and organizational variables. In most cases, environmental psychology research focuses on the uni-directional impact of specific physical features of the environment upon student classroom behavior, achievement, and attitudes.

There have been a number of models proposed in the educational, psychological and architectural literatures over the past 20 years which attempt to characterize the many dimensions of the school environment. Three models have been identified from the educational literature: Hoy & Miskel's social systems model for schools (1991); Anderson's interactive model of environmental dimensions and their interactions with school climate (1982); and Centra & Potter's structural model of school and teacher variables influencing student learning outcomes (1980). From the literature in environmental psychology, three models have been identified: the ecological model of school environments of Barker and Gump (Barker & Gump, 1964; Gump, 1987); Moos' school environment assessment model (1979); and Bronfenbrenner's hierarchy of ecological systems model (1977). Finally, from the architectural literature, two models have been identified which have implications for modeling school environments: Markus' conceptual model of the system of building and people (1972); and Weisman's environment-behavior systems model (1981).

The models identified above represent attempts that come closest to establishing a ecological or holistic view of educational environments (See Table 6.1 Ecological Models of the Educational Environment).

Although the studies identified exhibit ecological research agendas, there is still a clear bias towards a specific component in the human-environment ecology most closely aligned with the particular field of inquiry: Hoy & Miskel (1991) emphasize social behavior in schools; Anderson (1982) emphasizes organizational and psycho-social climate of school settings; Centra & Potter (1980) focuses on student learning outcomes; Gump (1987) emphasizes the behavior setting and individual behavioral responses as the centerpiece of his ecological perspective; Weisman (1981) emphasizes the primacy of environmental experience; while Markus (1972) emphasizes aspects of the physical environment over individuals and groups. Each model, however, while emphasizing particular dimensions of the human-environment ecological system, offers insight into different aspects and ways of viewing the system which must be taken into account.

In the following eight sections, each model is briefly described and critiqued in terms of its conceptualization of the educational environment and its contribution to a comprehensive conceptual framework. The following questions were posed to the eight models:

(1) How does the model conceptualize the educational environment?

(2) What is the intent of the model?

(3) To what extent does the model represent a whole-systems perspective?

Table 6.1 Ecological Models of the Educational Environment

Source	Name	Type of Model and Components	Outcomes
Hoy & Miskel (1991)	Social systems model for schools	Interactional School as a social system consisting of congruence relationships between Institution (Bureaucratic Expectations), Work Group (Informal Norms) and Individual (Work Motives).	Social behavior
Anderson (1982)	Interactive model of environmental dimensions and their interactions w/ school climate	Ecological Environmental dimensions of school climate: Milieu, Culture, Ecology, Social System	School climate
Centra & Potter (1980)	Structural model of school an teacher variables influencing student learning outcomes	Structural/Interactional School or school district conditions; teacher characteristics; within school conditions; student characteristics; teaching performance; student behavior	Student learning outcomes: basic skills, other cognitive outcomes; non-cognitive measures
Gump (1987)	Ecological behavior -setting model of school environments	Ecological An ecological behavior setting consists of action structures (or programs) and the physical milieu. The physical milieu consists of milieu regions, positions and manipulanda	Behavior settings
Moos (1979)	Model of the relationship between environmental and personal variables and student stability and change	Ecological A social-ecological conceptual framework to evaluate educational settings consisting of the following domains: environmental system, personal system and mediating processes (cognitive appraisal, activation and arousal, and efforts at adaptation and coping) which effect student stability and change	School climate
Markus (1972)	Conceptual model of the system of building and people	Structural/Interactional Subsystems: Building, Environmental, Activity, Objectives, Resources systems.	An open, dynamic system which maintains stable adaptation
Weisman (1981)	Environment-behavior systems model	Organismic Individual's goals and needs; Organization's long-range objectives and policies; and the Physical environment (properties and components).	Environment-as-experienced (attributes: comfort, crowdedness, privacy, control, legibility & meaning, etc.)
Bronfren-brenner (1977)	Hierarchy of ecological systems model	Ecological A nested hierarchy of setting structures which combine to create an ecological environment: the microsystem, mesosystem, exosystem, macrosystem	System stability and change

6.1.1 Hoy and Miskel's Model of Social Systems for Schools

1. How does the model conceptualize the educational environment?
Hoy & Miskel (1991) is an adaptation of the Getzels-Guba systems model of social behavior and the administrative process first proposed in 1957[8]. Hoy and Miskel's model of social systems for schools (1991; 36-43) places emphasis on the school as a social system consisting of congruence relationships between the Institution (Bureaucratic Expectations), the Work Group (Informal Norms) and the Individual (Work Motives). The model illustrates the continuous tension which exists between bureaucratic, informal and individual elements in the organization. This social system, internal to the organizational system of the school, receives Inputs (Resources, Values, Technology, History, Community, State and National Demands, and the Board of Education) , and provides Behavioral Outcomes (Adaptation, Goal Achievement, Integration and Latency) (see Figure 6.1). Finally, Behavioral Outcomes provide the drive for both internal and external feedback to the organizational system of the school.

2. What is the intent of the model?
Formal organizations are organizations established to achieve certain goals. They are often at odds with both individual member needs and values and the emergent patterns of social life of informal work groups (such as their informal practices, values, norms and social relations). In addition, external forces put strains on the formal organization as well. In order for a formal organization to survive, it must accomplish the goals it has set out to achieve. The model attempts to focus on these various determinants of behavior within formal organizations in order to further the research and practice of educational administration. The social systems model is intended to draw attention to several key organizational concepts useful to the theory and practice of educational administration (Hoy & Miskel, 1991; 43-53): effectiveness, efficiency and satisfaction; morale; leadership style; bureaucratic socialization; conflict; organizational effectiveness; and organizational problem analysis in schools.

3. To what extent does the model represent an ecological perspective?
Hoy & Miskel's Social Systems Model for Schools offers a highly integrated model of the school environment. Individual, group and organizational aspects of educational environments are carefully considered and are given equal weight. A full range of social and behavioral complexities are dealt with in the model. The model represents years of integration of the literature on educational administration.

The model emphasizes the primacy of organizational outcomes over individual and group outcomes. Goal achievement, adaptation and integration of the formal organization are seen as the ultimate behavioral outcomes of the system. It is hypothesized that organizational goals are generated through the resolution of congruent relationships between the institution, informal work groups and individuals. The authors postulate, for instance, that "the greater the degree of congruence among the elements of the system, the more effective the system" (Hoy & Miskel, 1991; 41). Effectiveness is defined as a congruence between individual motivations, informal group norms and formal expectations. The closer the first two

[8] Getzels, J.W. and Guba, E.G. (1957). Social behavior and the administrative process. *The Social Review, 65*, 429.

elements come to be congruent with formal expectations the more effective the organization will be in reaching its formal goals. Nevertheless, the model clearly emphasizes goals and outcomes which maintain the formal organization over individual and work group goals . The impact and role of the physical setting of the school on the goals of the organization is absent from this model.

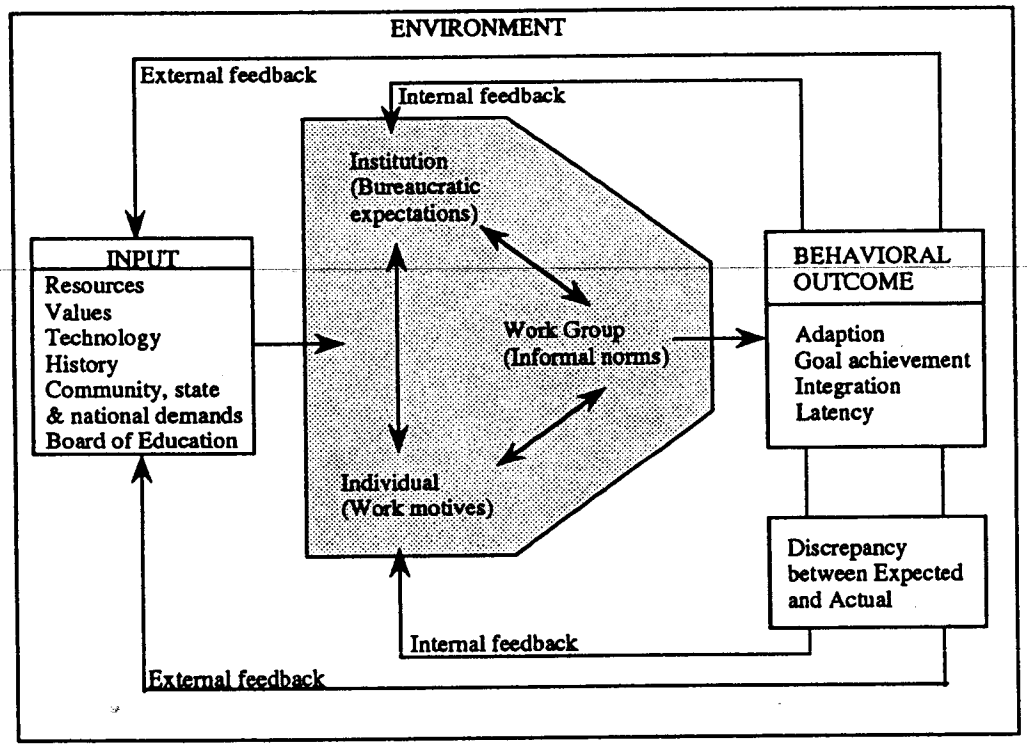

Figure 6.1 Hoy and Miskel's model of social systems for schools
(Adopted from Hoy & Miskel, 1991)

6.1.2 Anderson's Model of Environmental Dimensions and School Climate

1. How does the model conceptualize the educational environment?
Anderson's interactive model of environmental dimensions and their interactions with school climate (1982) is a synthesis of the research literature on school climate compiling over 200 references on the subject (see Figure 6.2). School climate is a construct which accounts for all factors which influence the "total environmental quality" of a school setting. The difficulty in defining school climate, a stepchild of organizational climate, is that it has evolved into a diversity of typologies, theoretical bases, variables to study, units of measurement choices and questions the validity of subjective and qualitative data. Anderson has developed a typology which emerges from a review of the literature on school climate; being defined by four interrelated dimensions:

(1) *Ecology:* physical and material aspects such as building characteristics (age, condition, size of school);

(2) *Milieu:* teacher characteristics and morale, student body characteristics and moral.

(3) *Social system* : administrative organization, instructional program, ability grouping, administrator-teacher rapport, teacher shared decisionmaking, good communication, teacher-student relationships, student shared decisionmaking, opportunity for student participation, teacher-teacher relationships, community-school relationships, involvement instruction; and

(4) *Culture*: teacher commitment, peer norms, cooperative emphasis, expectations, emphasis on academics, rewards and praise, consistency, consensus and clear goals.

2. What is the intent of the model?
From the widest perspective, it is believed that understanding the influences on school climate will improve the understanding and prediction of student behavior. The model is intended to first provide some basis for comparison within the school climate literature. The article suggests that policymakers are interested in identifying mechanisms which can be easily manipulated to affect student outcomes such as achievement. It is not clear that the construct of school climate is specific enough to accomplish such policy objectives. In addition, researchers do not agree on either the possibility or desirability of identifying school climate.

3. To what extent does the model represent an ecological perspective?
School climate, as a construct, is more holistic than simple elementalism (that is, discrete entities or elements that interact). School climate research attempts to take into consideration school processes (social organization) as well as static variables. Historically, school climate research has emphasized the concentration on the relationships between component elements, rather than on a conceptualization of the total organization. This model attempts to rectify this situation by providing a more holistic perspective of the mechanisms behind elemental relationships.

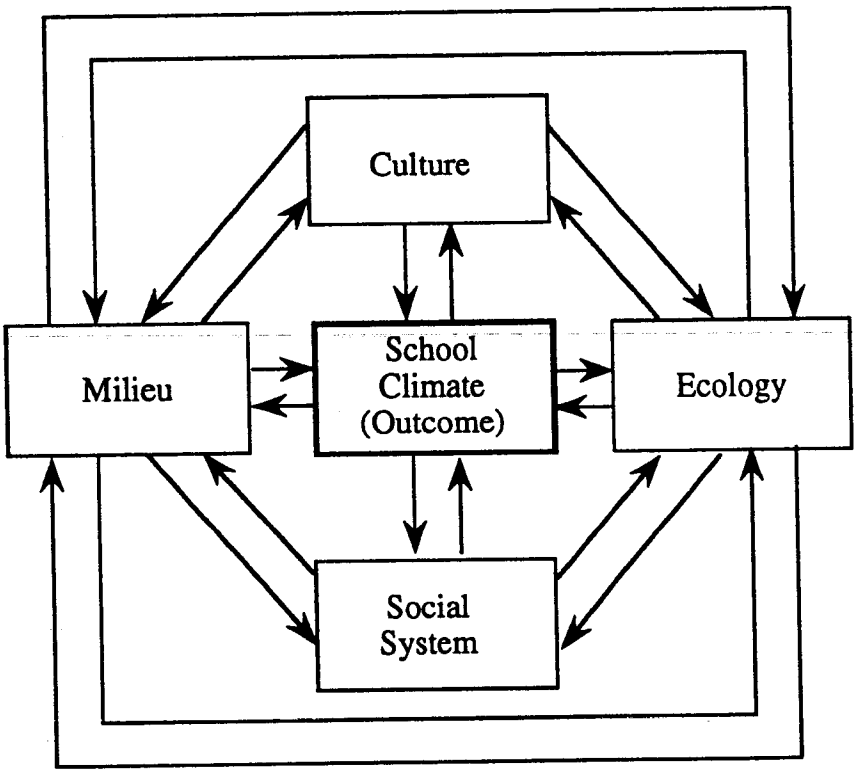

Figure 6.2 Anderson's interactive model of environmental dimensions and their interactions with school climate (Adopted from Anderson, 1982; 405)

6.1.3 Moos' Model of the Relationship Between Environmental and Personal Variables and Student Stability and Change

1. How does the model conceptualize the educational environment?
In his book *Evaluating Educational Environments* (Moos, 1979; 1-21), Moos presents what he calls a social-ecological conceptual framework to evaluate educational settings, and develops scales that measure the social environments of school settings. The conceptual framework focuses on the importance of four domains of environmental variables on stability and change in student behavior and attitudes.

The model in Figure 6.3 recognizes the existence of the environmental and personal systems which influence each other through what he calls selection factors (people selecting environments and other members) and mediating processes (cognitive appraisal, activation and arousal, and efforts at adaptation and coping).

The environmental system is categorized into four major domains: (1) *physical setting* (e.g., architecture, physical design layouts and arrangements), (2) *organizational factors* (e.g., size, faculty-student ratio, average salary level, affluence), (3) *the human aggregate* (e.g., age, ability level, socioeconomic background, educational attainment as situational variables), and (4) *social climate*. Moos focuses on the extent to which social climate is determined by and mediates the influence of the other three domains.

The personal system is categorized into individual background characteristics such as *age, sex, ability level, interests and values, ego strength and self-esteem, preferences for certain coping styles, attitudes and expectations*.

Mediating processes (*cognitive appraisal, activation and arousal, and efforts at adaptation and coping*) have the potential to change aspects of both personal and environmental systems. For example, a student who joins an organization may change his or her attitudes (a change in the personal system) while at the same time creating a new social group within the organization (a change in the environmental system); this event would be an example of the step called "efforts at adaptation and coping." Efforts at adaptation lead to index outcomes such as personal values and interests, aspiration levels, mood, self-concept and health, resulting in either stability or change in student behavior. This change can lead to the possibility of changing the environmental and personal systems, to either regain stability or affect change, depending on the circumstances.

2. What is the intent of the model?
Moos' primary concern for developing this model is to focus on social climate in a variety of settings. This model particularizes his work on the evaluation of the social climate of educational environments. The social environment of the school has been measured using the Learning Environment Inventory (Anderson & Walberg, 1974) and the Individualized Classroom Environment Questionnaire (Rentoul & Fraser, 1977), across three domains: relationship, personal growth, and system maintenance and change.

3. To what extent does the model represent an ecological perspective?
Moos indicates that many investigators focus on impact and evaluate only those variables of educational settings they believe to be related to the outcome they aim to explain. This approach often leads to the omission of factors that may affect outcome and trivialize the understanding of the environment and the processes by which it

functions. Moos advocates that the educational setting must first be adequately conceptualized before its impact on students' attitudes and behavior can be evaluated (Moos, 1979; 20-21). The model developed by Moos emphasizes his concern with environmental assessment as an intermediate step towards staff and program evaluation, and on-going efforts to change and improve students' learning settings.

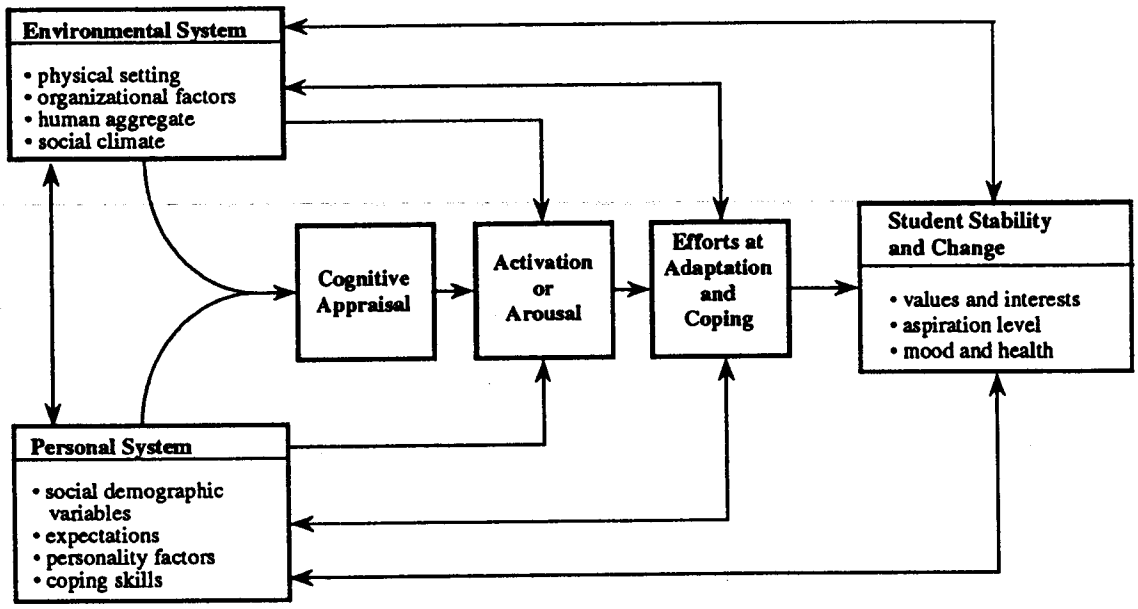

Figure 6.3 Moos' Model of the Relationship Between Environmental and Personal Variables and Student Stability and Change (Adapted from Moos, 1979; 5)

6.1.4 Barker & Gump's Ecological Theory of Behavior Settings

1. How does the model conceptualize the educational environment?
Barker & Gump (1964), and Gump (1978, 1987) have developed an ecological theory of behavior settings which has provided them with a unique conceptual framework and research agenda for school and classroom environments for the past thirty years. The objective of Barker and Gump has been to describe educational environments from an ecological perspective.

An ecological behavior setting is defined as an entity which consists of a mutually defining relationship between an action structure (or program) and a physical milieu (spatial configuration or arrangement). It is theorized that these two components of the behavior setting will tend toward synomorphy, or "similarity of shape" (Barker, 1968). For example, participants in a reading circle accept a certain action structure in order to carry out the day's lesson; the physical arrangement of chairs in the reading circle (physical milieu) has an interlocking relationship with the action of reading in turn with discussion between taking turns reading (action structure or program) (Gump, 1987; 692).

Schools and classrooms within schools can be considered clusters of behavior settings. Gump distinguishes between three main environments in the school setting: physical milieu (milieu regions, positions and manipulanda), action structures (programs) and psychological (individual affective and cognitive states); the first two comprising behavior settings.

2. What is the intent of the model?
From Gump's point of view research on school environments is not approached from an ecological perspective: the physical environment of the school is investigated independent from the program, resulting in studies which do not give equal attention to the impact of the program on student achievement. The reverse can be said to be true in the educational research literature.

The intent of the behavior setting theory is to explicitly recognize the interrelated and inseparable nature of physical environments and the action structures they are designed to accommodate. Gump feels that our difficulties in the development of useful research findings is related to the fragmentary nature of the "pre-yield," in contrast to identifying relevant contextual units, or viewing instruction as a process of establishing and maintaining classroom activities. Gump suggests that establishing these contextual units is necessary to keep from "drifting" into the phenomena of individual psychology. He feels that teachers and administrators already think and act in terms of larger units such as activities, classes, meetings, assemblies. What is needed, then, is research which addresses the concerns of teachers and administrators (Gump 1987; 726). Within this conceptualization, it is theoretically possible to manipulate either one of these environments, affecting the other by implication, thereby impacting the psychological environment of individual students in some positive direction.

3. To what extent does the model represent an ecological perspective?
The model does not consider the organizational rules and regulations which comprise school structure beyond the behavior setting. It can be argued that behavior settings are impacted by external factors such as organizational goals, expectations, rules and sanctions, as well as the presence of other competing behavior settings. The model

rules out any investigation of individual student attitudes (the psychological environment), investigating instead only individual behavior without regard for motivation. In addition, individual differences cannot be tracked either utilizing this model.

6.1.5 Centra & Potter's Structural Model of Variables Influencing Learning Outcomes

1. How does the model conceptualize the educational environment?
Centra & Potter's model (1980) emphasizes groups of variables which combine to influence specific student learning outcomes (see Figure 6.4). The model identifies causal as well as correlational relationships between these variables. Teacher characteristics are influenced by school or school district conditions (school size, resources, ratios, services, facilities, class size, location of school, social class, race) and internal school conditions (administrative and instructional organization, peer group influences, class size environment or ambiance and quantity of schooling). These influences affect teacher performance, student behavior and student learning outcomes. Student characteristics are seen as influencing teacher performance, student behavior and learning outcomes.

2. What is the intent of the model?
Centra and Potter felt that given the numerous methodological problems associated with acknowledging all possible factors associated with student learning, no single study ever has, nor ever will, adequately investigate the influence of all these factors. Nevertheless, the authors present a structural model of the factors they believe affect student learning, primarily for its heuristic value in conducting structural analysis techniques (e.g. path analysis).

3. To what extent does the model represent an ecological perspective?
The model represents the structural relationships established through the review of school productivity research and school effects studies. In this sense, the model represents an attempt to synthesize the state of empirical research conducted on the factors which effect student achievement as the final outcome. The model, while taking into consideration the many aspects of the educational environment, focuses primarily on one particular outcome without allowing for opportunities for research on the other aspects of the educational environment that do not directly impact student achievement.

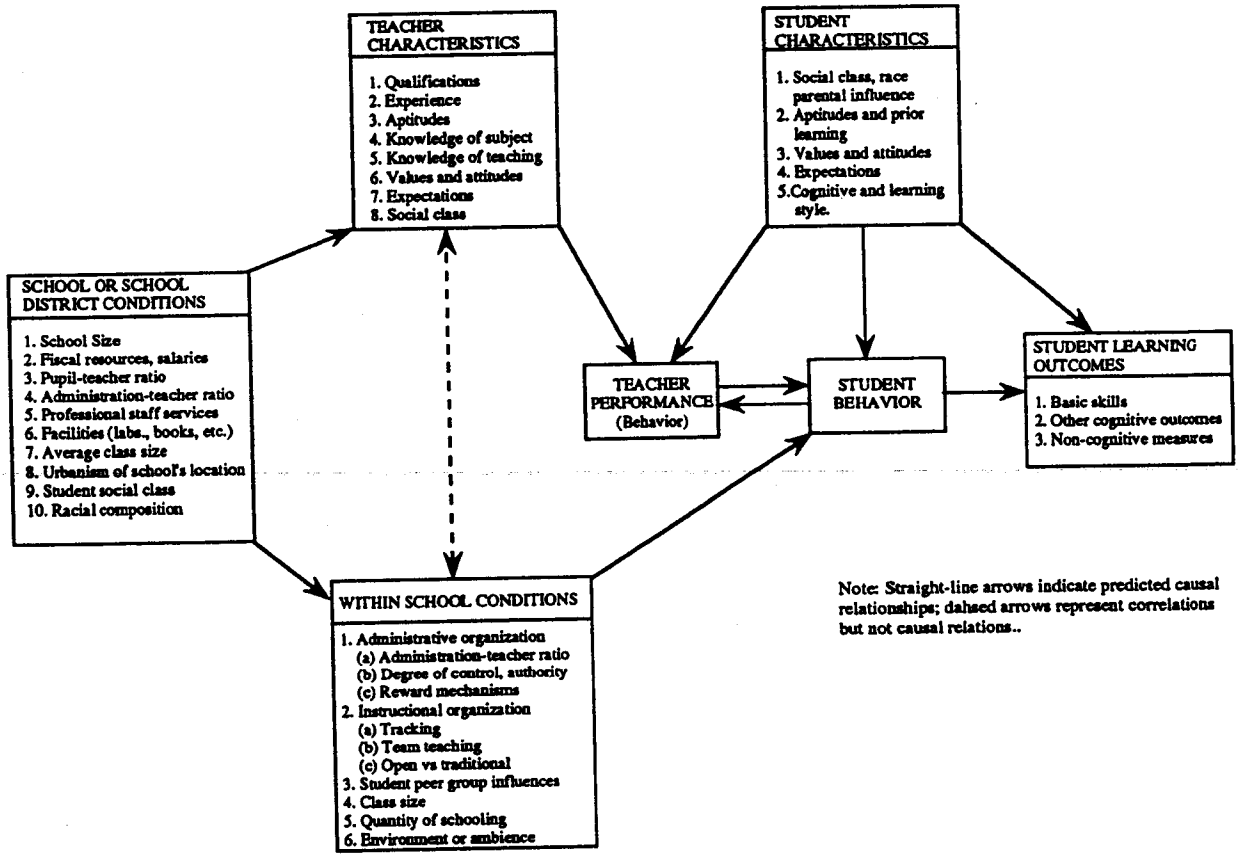

Figure 6.4 Centra & Potter's structural model of school and teacher variables influencing student learning outcomes
(Adopted from Centra & Potter, 1980)

6.1.6 Markus' Conceptual Model of the System of Building and People

1. How does the model conceptualize the educational environment?
The conceptual model of the system of building and people (Figure 6.5) includes the building system (hardware such as construction, services and contents), the environmental system (spatial and physical), the activity system (identification, control, communication, informal activity, and workflow), the objectives system (production, adaptability, morale, stability) and the resources system (cost of provision, cost of maintenance, cost of activity, and the value of achieving a particular objective). This model can be extended into time (Figure 6.6) from conception to building demolition to form a dynamic homeostatic model of environmental change.

2. What is the intent of the model?
The objective of the research conducted by the Building Performance Research Unit (BPRU), and supported by the RIBA, was to develop a set of appraisal techniques to evaluate completed buildings. School buildings were chosen as the sample of buildings to be appraised by the BPRU using this conceptual model.

3. To what extent does the model represent an ecological perspective?
Markus' conceptual model of the system of building and people is the only model of the school organization thus far which takes into account changes in the school environment over time (see Figure 6.6). The model has the potential of integrating all aspects of decisionmaking in the organization, from administrative to educational to facilities management, by incorporating two activity sub-systems: design (control) and production. Design is part of most human activity patterns: it can be conceived as a generative sub-system of a larger system and is present and continuous from the inception to demolition of the building.

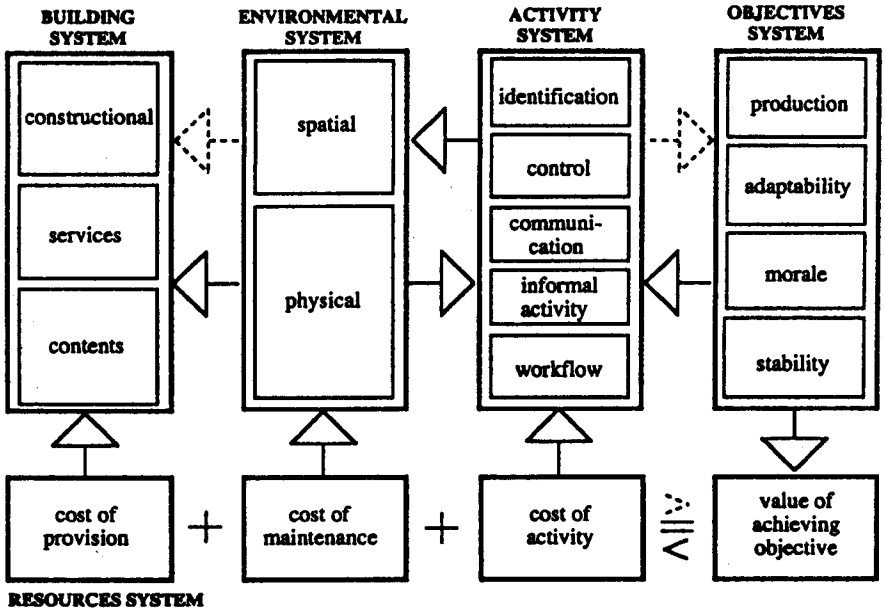

Figure 6.5 Markus' conceptual model of the system of building and people (Markus, 1972)

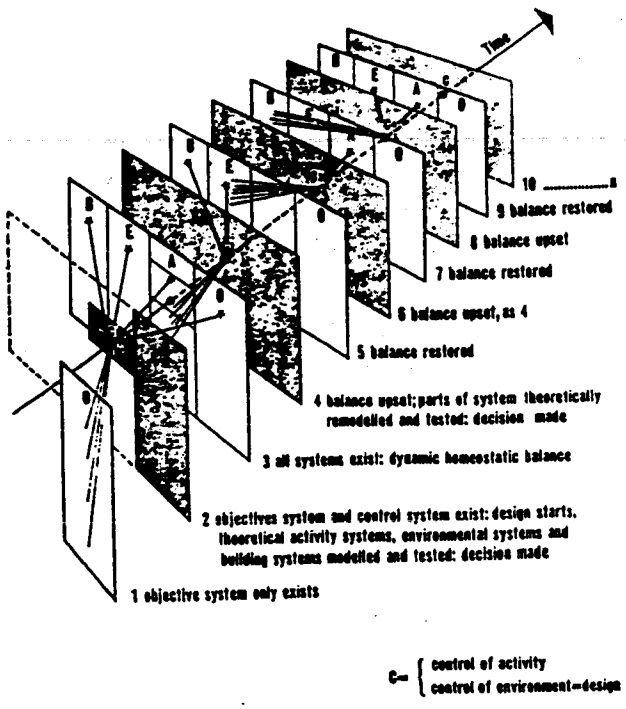

Figure 6.6 The system model extended in time (Markus, 1972)

6.1.7 Weisman's Environment-Behavior Systems Model

1. How does the model conceptualize the educational environment?
The environment-behavior systems model was conceptualized to generalize organizational/institutional type settings (Weisman, 1981). The outcomes of the environment-behavior systems model (EBS model) emphasize the characteristics of the "environment-as-experienced," represented by environmental attributes such as sensory stimulation, comfort, activity, crowdedness, privacy, legibility, meaning among others (Figure 6.7). The model identifies three factors, or subsystems, which influence this environment-as-experienced: individuals, organizations and the physical setting. Each of these components of the environment-behavior system can be seen as comprising two levels or scales. The individual component is comprised of patterns of behavior which are directed by goals or needs. The organization embodies long-term objectives which serve to shape everyday policies and rules. Finally, the physical environment is comprised of physical building components (such as walls, windows, light fixtures, HVAC equipment, and tables and chairs) each of which has corresponding sensory and spatial properties (such as size or shape of rooms, views, illumination, temperature, and workspaces) which are in turn experienced by the individuals of that setting. The environment-behavior systems model emphasizes the complex ecological nature of the setting, in which the environment is influenced at all times by interactions between the organization, individuals and the physical environment.

2. What is the intent of the model?
The environment-behavior systems model was originally developed by Weisman in an effort to embrace two theoretically different approaches: one emphasizing the objective, interactional aspects of the environment and the other emphasizing the subjective or phenomenal aspects of the environment (that is, "environment-as-experienced"). The model provides a synthesis between these two approaches to conceptualizing the environment allowing analysis of environments across both objective and subjective domains.

3. To what extent does the model represent an ecological perspective?
The model is successful in cogently categorizing an educational setting from the points of view of many different constituencies simultaneously. It is flexible enough to deal with all aspects of the environment-behavior system. The environment-behavior systems model does not, however, explicitly deal with the social environment created by group goals and activities, often at odds with both individuals and the organization. In addition, the model does not explicitly identify external social, cultural, economic and political factors continuously impinging on the organization and its members.

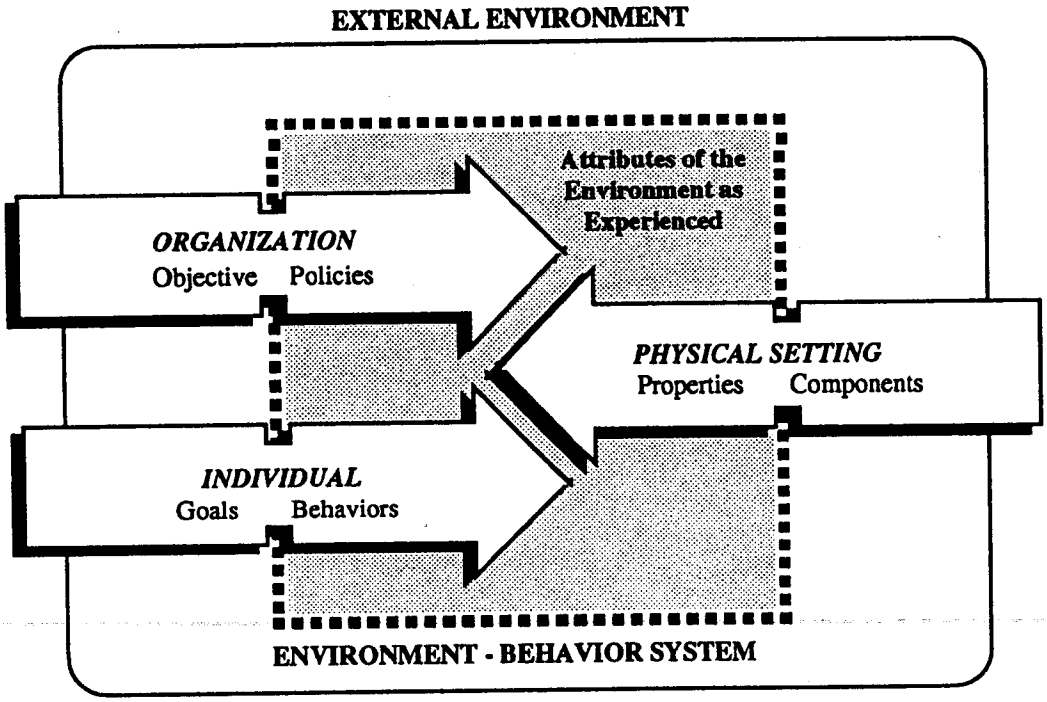

Figure 6.7 Weisman's Environment-Behavior Systems Model
(Adopted from Weisman, 1981)

6.1.8 Bronfenbrenner's Hierarchy of Ecological Systems Model

1. How does the model conceptualize the educational environment?
In an attempt to clarify the levels or scales of influence which are an inherent part of ecological systems, Bronfenbrenner developed a nested hierarchy of setting structures which combine to create an ecological environment: the microsystem, mesosystem, exosystem and the macrosystem. The *microsystem* is the "complex of relations between the developing person and the environment in an immediate setting containing that person...a setting is defined as a place with particular physical features in which the participants engage in particular activities in particular roles for particular periods of time (Bronfenbrenner, 1977; 514). These six components of a setting -- place, physical features, participants, activities, roles, and time -- defined the variety of influences that ecological research in a microsystem should take into account.

A *mesosystem* "comprises the interrelations among major settings containing the developing persona at a particular point in his or her life" (Bronfenbrenner, 1977; 515). The mesosystem, then, is a constellation of all microsystems, or settings, an individual is currently experiencing. An *exosystem* "is an extension of the mesosystem embracing other specific social structures, both formal and informal, that do not themselves contain the developing person, but impinge upon or encompass the immediate settings in which that person is found, and thereby influence, delimit, or even determine what goes on there" (Bronfenbrenner, 1977; 515). This level goes beyond identifiable "settings" to include other forces which shape the lives of individuals in a society such as mass media, government, and the distribution of goods and services. Finally, the *macrosystem* "refers to the overarching institutional patterns of a culture, or subculture, such as the economic, social, educational, legal, and political systems, of which the micro-, meso-, and exo-systems are the concrete manifestations. Macrosystems are conceived and examined not only in structural terms but as carriers of information and ideology that, both explicitly and implicitly, endow meaning and motivation to particular agencies, social networks, roles, activities and their interrelations" (Bronfenbrenner, 1977; 515). In other words, the macrosystem is a set of general patterns by which a culture establishes itself.

2. What is the intent of the model?
Weisman's EBS model is one of the few models which attempts to differentiate several levels of operation of particular dimensions. Extending and expanding this idea of levels or hierarchies, Bronfenbrenner (1977) offers a model of the human environment which explicitly articulates levels of dimensional operation not often addressed in the literature.

3. To what extent does the model represent an ecological perspective?
The value of Bronfenbrenner's model is that, like the EBS model of Weisman, each dimension of the model exists at all levels of the hierarchy simultaneously. As a result, all aspects of the environment can be examined at each of the four levels of the setting. Unfortunately, Bronfenbrenner does not carry out the implications of his six components of the setting (place, physical features, participants, activities, roles and time) mentioned in the microsystem at the other three levels of his model. It is possible that these components continue to manifest themselves at the higher levels of the ecological system.

6.3 A COMPREHENSIVE MODEL OF EDUCATIONAL ENVIRONMENTS

The majority of empirical research on educational environments does not build on a comprehensive understanding of the school environment as an ecological system of interrelated dimensions. Admittedly, evaluating the educational environment as a totality may be an impossible task. However attempting to deal with the complexity of these dimensions at some level is critical if a more effective approach to solving the problems associated with providing supportive learning environments for children is to be realized.

The Multidimensional Model of Educational Environments (MMEE) developed here incorporates the above insights from the educational, environmental psychology and architectural literature by synthesizing them into a more comprehensive framework that can be seen to characterize all organizations. The MMEE emphasizes the ecological nature of dynamic relationships between five distinct dimensions of the total environment of the school: personal, social, organizational, physical and temporal. Each of these components or dimensions are conceptualized as existing at five hierarchical levels: context, goals, actions and two levels of outcomes (See Figure 6.8).

Aspects of each cell in the model (Dimension x Level) can be fully known, implicitly known or even hidden by any one individual or group of individuals. In other words, aspects within each cell are either explicit or tacit to individuals participating in a certain activity or function depending on the circumstances of their involvement. In this sense, the model follows the intent of Weisman's environment-behavior system model (1981) in attempting to represent both objective and subjective aspects of the human-environment system.

Dimensions of the Model

The Multidimensional Model of Educational Environments emphasizes the ecological nature of the relationship between four distinct dimensions of an environmental system: *the personal, the social, the organizational, physical, temporal* (see Figure 6.8). These dimensions follow Weisman's environment-behavior system model with the addition of explicit social and temporal dimensions. Following Barker and Gump's behavioral setting theory, while each dimension of the setting or educational environment can be described, defined and operationalized independently, to understand the any one dimension requires an examination of each dimension in relation to other dimensions. The implications of this complex of relations between dimensions suggests that behavior is more than just a sum of the dimensions of person and environment, but that behavior is a consequence of the unique interaction between person and environment above and beyond their separate influences.

Hierarchical Levels of the Model

Each of these components or dimensions exist along five hierarchical levels: *context, goals, actions,* and two levels of *outcomes*. This aspect of the model was inspired by Bronfenbrenner's hierarchy of ecological systems model with the actions level representing Bronfenbrenner's micro- and mesosystems.

Contextual Level

The *context* refers to extra-organizational, societal, and cultural influences on all dimensions in the model. Individuals and social groups (personal and social dimensions) are influenced by cultural norms and expectations which are part of

Dimensions / Levels	Personal	Social	Organizational	Physical	Temporal
Context	Cultural norms & expectations of individual participants	Cultural norms & expectations of various groups	Extra-organizational influences (boards, citizens, society)	Building Industry	Historic Events
Goals	Long-range & immediate goals of individual participants	Long-range & immediate goals of various groups	Long-range & immediate goals of the school	Design intent in relation to educational program	Strategic planning processes
Actions	Behavioral, affective & cognitive states of individual participants	Group interaction and activities	Curriculum & other organizational policies	Physical design systems & components	Scheduling & Events
Outcomes	Student learning outcomes	Effectiveness of communication & cooperation in achieving goals	Effectiveness & efficiency in reaching educational goals	Attributes of place	Events in present moment
Ecological Outcomes	Environmental Quality School Climate Quality of Education				

Figure 6.8 Multidimensional Model of Educational Environments

general society and not under the control of an organization. For example, in American society, individuality, autonomy, and self-reliance are generally accepted as ideal, acceptable and desirable traits. These traits have an influence on what will and will not take place within a particular organizational setting. Working in groups, for instance, might be an undesirable activity for many individuals accustomed to the accolades rewarded to individual achievement, thus putting a strain on aspects of organizational effectiveness. Within the realm of organizational dimension, the context takes the form of extra-organizational influences that include such bodies as local school boards, local, state and federal government laws, regulations, and statutes, parent groups, citizen taxpayer groups, corporate sponsorships, and the general level of social and economic vitality of the local community. The dimension of the physical environment also manifests itself at the level of context in the form of the building industry which includes current facility development practices and procurement strategies, as well as prevalent architectural styles of an area or region, and availability of building technologies, structural systems and building materials. Finally, the temporal aspects of the environment are manifested as historical events that form collective memories, both positive and negative, about a particular school setting.

Goals Level

The *goals level* of the educational environment within the personal and social dimensions include long-range goals, objectives and agenda which influence directly how an individual or group acts in the setting. Within the organizational environment, the goals includes such aspects as mission statements, long-range strategic goals, curriculum planning and decision-making. Following the implications of Markus' conceptual model of the system of building and people (1972), the facility design, planning and management function is embedded in the organizational environment at this level. At the intersection of the goals level and the physical environment dimension, the intent of the building design is expressed as it relates to the educational program. Goals are manifested through temporal dimensions of the environment as well, including such processes as strategic and operational planning.

Actions Level

The *actions level* of the educational environment within the dimensions of personal and social environments include the immediate wants and abilities of students, teachers, administrators, support staff and parents. The organizational dimension includes such aspects as rules and policies, administrative decisionmaking, and expectations, rewards and sanctions of the organization, as well as curriculum and instruction strategies. Management, a sub-component of the organizational dimension at this level illustrates the place for facility management in the on-going management and operations of the system. The physical environment dimension manifests physical components and properties at this level of the system such as structure and enclosure systems, environmental control systems, classroom size and shape, school size, levels of illumination, sound absorption, flexibility, etc. Finally, the temporal aspects are ubiquitious at the level of actions. It is at this level of the system that dynamic relationships between the five dimensions of the system become increasingly overlapping and mutually defining. Dynamic interaction between dimensions are often manifested in the form of conflict. For instance, an individual student's abilities may not match the wants and abilities required by a particular student study group, or the goals of an informal teacher group may be at odds with some established organizational policy. Adjustments must be made by either or both dimensions in order to insure the smooth operation and continuance of the system.

How these conflicts and interactions between dimensions of the system are resolved will influence the outcomes of the system.

Outcomes Level

The model also suggests there exist two distinct theoretical levels of outcomes. The dimensions of the system at the most immediate level of the educational environment are linked directly to the first level of these outcomes: first-order outcomes. First-order outcomes can be analyzed according to any or all of the five dimensions or units of analysis. Outcomes at the personal dimension include individual behaviors, attitudes and cognitive states of students, teachers and administrators. At the dimension of the social environment, outcomes include group interaction and activity. At the organizational dimension outcomes include aspects of effectiveness and efficiency, such as in reaching established educational goals. The physical and temporal dimensions can be investigated at the level of first-order outcomes in relation to the personal, social and organizational dimensions. Attributes of the physical environment such as privacy, crowdedness, control and legibility can be evaluated in relation to personal, social and organizational use of space. Finally, temporal dimension issues such as scheduling and event timing can be reviewed in relation to individual, group and organizational actions.

These various outcomes combine to influence what can be identified as second-order, or ecological outcomes and include such constructs as environmental quality, quality of education, quality of life, meaning, congruence, and sense of place. Within the context of educational environments, school climate is a unified system outcome constituting a holistic construct comprising aspects of all five dimensional outcomes. A characteristic of ecological outcomes is that they have continually proven difficult to assess (see Anderson, 1982 for a description of the problems connected with assessing school climate). Unified system outcomes can be conceptualized as feeding forward back into the contextual level of the educational environment. For example, changes in the 'quality of education', such as evidence of decreased student performance with respect to other industrialized countries, may adversely affect social and cultural attitudes towards the educational system inciting yet another round of educational reform from outside the system. Educational reform measures may, in turn, have an impact on the goals, and subsequent actions of the educational system.

At the first level, outcomes are interactional in nature, while at the second level outcomes are ecological in nature. At the first level, outcomes are particular to a specific dimension of the school environment , while at the second level, outcomes are considered more integrated and holisitic in nature. First order outcomes are more readily measurable, while second-order , ecological outcomes are more ambiguious and difficult to measure.

6.4 CONCLUSIONS: IMPLICATIONS OF THE MODEL

The multidimensional model of educational environments shows promise of capturing the full range of realities which comprise the school environment. In addition, the model can be utilized by both educational researchers and practitioners.

Implications for research

Theoretically, the model is able to integrate multidisciplinary research across several domains: environmental psychology, sociology, architecture, educational

administration and educational psychology. The model also provides an opportunity for the application of knowledge on the educational environment by placing it in a broader context.

The model challenges the current status of empirical knowledge on the educational setting. Substantively, work on the relationship between the physical environment of the school and educational programs has focused primarily on personal characteristics and outcomes such as student behavior, attitudes and achievement. For instance, student achievement has been found to be directly affected by class and school size. Physical setting characteristics such as seating position, windowless classrooms, thermal and acoustic conditions, classroom configuration and design, open and conventional classrooms, have all been found to affect student and teacher attitudes and behavior without significantly affecting achievement scores. The combined effect of the physical environment on achievement is not definitively known. In addition, the mediational effects of these variables on achievement has not been investigated. This model provides the platform for the investigation of these issues.

How, for instance, do teacher attitudes about the physical classroom conditions affect student achievement? Do students' attitudes and behavior as a partial result of environmental conditions (hot, cold, noisy) affect their performance on tests? If so, do student attitudes towards the physical setting influence their ability to perform on tests? To what degree are teacher attitudes a function of simple classroom layout (e.g., frustration at not being able to see students around corners, not having enough storage space, etc.)? To what degree is the inability of a teacher to execute a particular instructional design (e.g., small group instruction in an open plan) based on a particular educational philosophy being implemented at the school? These are the kinds of questions which arise when a researcher looks more ecologically at the educational setting within which students try to learn and teachers attempt to instruct.

Other substantive issues which have not been addressed by the literature include the special problems of urban schools, the role and impact of facility management policy and its effects on the environmental quality of the school, and, as stated earlier, an investigation of the interactional effects of the physical setting on learning through the behavior and attitudes of teachers, students and administrators.

Reframing the situation of the school environment in terms of its ecological setting suggests that the dynamic balance between the four dimensions of the educational environment will bring about better test scores, attitudes and social behavior. If groups and individuals work in concert with organizational goals, and the physical environment is designed and managed in accordance with those goals, yet flexible enough to respond to changes in the educational setting, outcomes at all levels of the educational environment will improve.

Implications for practice

The Multidimensional Model of Educational Environments could be useful not only as a research tool for educational researchers, but also as a practical assessment device for educational policy makers, school administrators, and planners of educational facilities who continuously grapple with the complexities of the school environment on a daily basis.

A school, practically speaking, is complex and multifaceted, but it nevertheless constitutes a singular entity with certain characteristics and goals. These goals -- the

educational mission -- must be addressed within a framework of competing realities, constituencies and motivations. In order for educational administrators to make the kinds of decisions that are required, they must understand the educational environment in its totality: how the organization is structured, formally and informally; the needs of the community as they relate to the goals of the school; the instructional and curricular goals of the teaching staff; the daily activities within the physical setting itself; and the needs of the children being served. This type of systemic understanding crosses all disciplinary boundaries and requires that an administrator cope with many different levels of concern simultaneously. Similarly complex decisions are made by teachers and academic staff daily. The model respects the multidimensional aspects of the school by providing a platform from which to evaluate diverse knowledge on educational environments.

Practice-based research

Researchers of the educational environment have much to learn from the knowledge and experience gained through educational practice. The creation of a theoretical framework for understanding educational environments has been born out of necessity: educational planners, architectural designers, and facility managers have, for too long, operated without full knowledge regarding the creation of an ecological educational environment which meets the needs of all constituencies simultaneously. Practitioners, by their very nature, must make decisions based on past experience and on their ability to predict future possibilities. Utilizing a comprehensive framework, researchers could learn more about the outcomes of these kinds of practical experiments practitioners conduct everyday and codify this valuable knowledge and experience through empirical research.

The success of the model in integrating a vast amount of knowledge on the educational environment is dependent on the its ability to clearly communicate that which are very complex sets of interrelationships. The model must ultimately confront the abilities of researchers and practitioners to deal with philosophical issues raised by the model. Can practitioners and researchers see the implications of these complex relationships between multiple dimensions, or will the conventional view of buildings as containers of activity continue to prevail? Does the basic model of education consider all possibilities? Is the model consistent with the conclusions drawn here? Does the current mode of architectural practice recognize educational needs? These are the types of questions that will need to be answered in the process of forming a common vision of educational environments. Adopting the long-range view and creating a comprehensive inclusionary image of educational environments is the only path to creating helpful, dependable, emotionally satisfying and equitably viable places for teaching and learning.

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Appendix
AN ANNOTATED BIBLIOGRAPHY OF EDUCATIONAL ENVIRONMENTS

This appendix presents an annotated bibliography of educational environments that identifies linkages between educational psychology, environmental psychology and environmental design research. The annotated bibliography drew from all three disciplines, both empirical and non-empirical work as well as primary and secondary sources. Sources collected were mapped onto the conceptual framework and analyzed. From this analysis, key sources were identified according to how comprehensively they investigated all dimensions of the educational environment. These particular sources (ecological models) have been more fully annotated in the concluding chapter. The following two Tables summarize the content of the annotated bibliography in terms of the multidimensional model (Table A.1), and in terms of empirical status (Table A.2).

Discipline	Dimension of the Educational Environment												Total
	Ecological		Organizational		Social		Personal		Physical		Temporal		
	Source No.	Subtotal	Source No.	Subtotal	Source No.	Subtotal	Source No.	Subtotal	Source No.	Subtotal	Source No.	Subtotal	
Architecture	79a	1	24,31	2		0	105, 106	2	4,18,19,20, 21,24,28,31,50, 51,67,76,77,84, 86,92,98,104, 105,106,107 108,112	23	8,14,22,25, 30,40,66,68, 71,74,81,82, 83,88,92,99, 101,105,126	19	47
Environmental Psychology	56	1	124, 125	2	13, 124, 125	3	2,3,5,7,29,33, 44,46,47,61, 79,89, 95,96, 111,117,122	17	3,5,13,44,46,47, 54,55,56,57,58, 59,60,79,89,91 95,111,117,128	20	9,45,61,91, 100	5	48
Education	1, 26	2	63, 75, 80, 109,123	5	35, 123	2	17,32,35,38, 70,113,114, 118	8	6,15,16,17,27, 32,34,36,41, 42,43,48,49,62, 69,72,78,80,85, 90,93,94,97, 102,103,113, 114,116,119, 120,127	31	11,12,23,37, 39,52,53,64, 65,73,87,110, 115,119,121, 126	16	64
Totals		4		9		5		27		74		40	159

Table A.1 Studies Concerning the Various Dimensions of the Educational Environment in Schools

Discipline	Empirical Sources		Non-Empirical Sources		
	Source No.	Subtotal	Source No.	Subtotal	Total
Architecture	30,67,101,105,106,79a	6	4,8,14,18,19,20,21,22,24,25,28, 31,40,50,51,66,68,71,74,76,77, 81,82,83,84,86,88,92,98,99,104, 107,108,112,126	35	41
Environmental Psychology	2,3,5,7,9,10,13,29,33,44,45,46, 47,54,55,56,57,58,59,60,79,89, 95,96,122, 125	26	61,91,100,111, 117,124,128	7	33
Education	6,15,17,26,32,35,36,38,41,42, 43,49,69,70,80,97,103,109,113, 114,118, 119,120, 123	24	1,11,12,16,23,27,34,37,39,48,52, 53,62,63,64,65,72,73,75,78,85, 87,90,93,94,102,110,115,116,121 126,127	32	56
Totals		56		74	130

Table A.2 Empirical Status of Studies Across Disciplines

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
1	Anderson, 1982	Education	Review of Literature	School Climate: Ecology, Milieu, Social system, culture	Unit of analysis is the whole school system	
2	Ahrentzen, 1982	Environmental Psychology	Annotated Bibliography	Personal	elementary school	
3	Ahrentzen, Jue, Skorpanich & Evans, 1982	Environmental Psychology	Review Literature	School environments and stress: Physical environment and Personal interactions	order and organization rule clarity elementary school	
4	Ahrentzen, 1988	Architecture	Historical Review	Physical setting: elementary school facilities	Open Education Elementary school	
5	Ahrentzen & Evans, 1984	Environmental Psychology	Empirical observations	Personal, then Physical setting	Elementary schools	
6	Armstrong, 1975	Education	Literature review	Physical settings: open classroom	Open Education Elementary school	
7	Axia, Baroni & Peron, 1990	Environmental Psychology	Empirical: observations questionnaires	Personal		
8	Bakos, Bozic & Chapin, 1987	Architecture	Non-empirical: Descriptive Case Study	Temporal Dimension	one ward in a large state institution for mentally retarded children	
9	Baldassarri, Lehman & Wolfe, 1987	Environmental Psychology	Empirical: Participatory action-research qualitative	Temporal Dimension	elementary school	group discussions w/ teachers, parents & community, children
9a	Ballast, 1987	Architecture	Bibliography	Physical setting	elementary schools child care centers	
10	Barker & Gump, 1964	Environmental Psychology	Empirical: observation	Whole system: the behavior setting		
11	Benit, 1990	Education	Non-empirical report	Temporal Dimension		
12	Berg & Apostle, 1991	Education	Non-empirical report	Temporal Dimension	Elementary & secondary schools	

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
			School Climate	School climate is a research paradigm the school building is a unit of inquiry school climate is the personality of the school smaller schools have increased community and awareness social system variables most critical to school climate: admin/teacher; student/teacher; community/school rel
Student behavior, performance and achievement	density noise spatial density social density (?)	design modifications in an open plan school		This review looks at physical components of EBS system (such as noise, social and spatial density, design modifications) which affect student variables (such as.. reading ability, open vs closed, physiological, motivational & congitive effects, peer interaction & development of cooperative interdependence, task & social behaviors, teacher/student rel., student behavior, performance, achievement
Student classroom experience task orientation locus of control achievement need attendance questioning behaviors persistence on tasks fidgeting behaviors creativity satisfaction with classroom participatory behav social disruptive beh student involvement commitment to school work	Seating Position Windows Study spaces Density School size thermal, luminous, noise Openness arrangement of furnishings soft/hard atmosphere accessibility of materials audiovisual stimulation boundary clarity		Environmental stress	See article for reviews of many articles related to school environments and stress The authors present a taxonomy for the study of stress in elementary school settings (p.246, table 8.1)
Mainstreaming the handicapped	Open Plan Windows and lighting Secluded study spaces Color, textured walls, carpeting, adj. lighting, cushioned benches (for comfort and noise reduction) wall hangings	Adaptability over time Flexibility		
student distraction teacher distraction	degree of classroom openness Secluded study spaces: desk type area volume, ceiling heights	classroom modifications	privacy	1. More open classrooms have increased distractions and less satisfaction 2. More spacious areas have less distraction & greater satisfaction 3. Class activities more likely to be restricted to prevent noise in more open settings 4. Secluded study areas used by students to achieve solitude & associated with increased privacy & satisfaction
effects on teachers: satisfaction leadership behavior student personal adjustment withdrawn behavior self-esteem risk-taking behaviors self-concept of students	open plan classrooms versus self-contained classrooms noise			
cognitive env assessment of both children & adults	photographed classrooms			• experience with different classroom types favors positive consideration of diff spatial arrangements, w/ bias toward highly furnished classrooms.
mentally retarded children's responses to designs	playroom and outdoor play structure	describes design process w/ children		using analogies instead of conventional images replacing "you can't" statements with statements of conflicts getting the questions right by being aware of a hierarchy of needs avoiding the Head Nurse by involving all Making a design: images into places immersion into a participatory process vs professional distancing
worked with children	focus of discussion of sessions was on images of what the physical setting could be. alternative environments	reports on process of involving children in imaging alternative schools		involvement of children in change process use of media raised issues about underlying power relations betw kids and teachers.
children	innovative school design			
				Behavior settings influence behavior of students and teachers
		facility planning facility assessment audits		
		prototypical designs with common building cores		• Prototype designs can capitalize on economies of scale

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Dimensions of the Educational Environment: Social Dimension
13	Berliner, 1983	Psychology	Empirical field observations	Physical setting & Social: Activity Structures	elementary schools	"reading circle" "seatwork" "two-way presentation" "one-way presentation" "mediated presentation" "silent reading" "construction" "games" "play" "transition" "housekeeping"
14	Bickmore, 1992	Architecture	Non-empirical report	Temporal Dimension		
15	Bourke, 1986	Education	Empirical: observation & questionnaire	class size: Physical Dimension	elementary school	Teacher practices: class groupings... whole class instruction, small group teaching monitoring of indiv student work
16	Bowers & Hamons, 1990	Education	Non-empirical report	Physical setting: school building design	community recreation center for community programs	community support Top 55 club for senior citizens
17	Brody & Zimmerman, 1975	Education	Empirical: observations questionnaires	classroom organization & personal space	elementary school	
18	Brubaker, 1989a	Architecture	Non-empirical report	Physical setting: impact of technology on educational facilities	elementary & secondary impact of technology on mission statements & philosophy of schools	
19	Brubaker, 1988	Architecture	Non-Empirical report	Physical setting: lessons in school planning	secondary schools	
20	Brubaker, 1989b	Architecture	Non-empirical descriptive case studies	Physical setting	Secondary schools	
21	Brubaker, 1990	Architecture	Non-empirical report	Physical setting		
22	Brubaker, 1991	Architecture	Non-empirical descriptive case studies	Temporal Dimension	Secondary schools	Community
23	Bullis, 1992	Education/ Facilities Management	Non-empirical report	Temporal Dimension		

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
number of students teacher role student attention			ATI: Aptitude-treatment interaction	classrooms are described in terms of the recurrent activity structures teachers use, which have different functions and possess rules and norms to guide student behavior in the structure Hypotheses about aptitudes that may foster or hinder achievement in different activity structures are suggested: Success in school, judged by school personnel, is some weighed composite of success in any of a number of activity structures and that different characteristics are needed to succeed in different activity structures.
		collaborative models of planning and designing schools		• being open to variety of experiences and being receptive to poss. • make dus with whatever is at hand • Identify indiv. w/ predisposition toward making connnections • questions & open-ended structures for thinking must be modus operandi • respect for others' points of view • meetings should have leaders • More connections possible through shared experiences
student achievement (math) teaching practices teacher questioning management of classroom noise homework practices	class size			• In smaller classes teachers more often taught the class as a whole and these classes had higher achievement • In larger classes teachers formed more groups and these classes had lower achievement • Smaller classes had fewer interactions & higher achievement • Teachers w/ small classes probed more frequently & their classes had high achievement.
	new community recreation facility	Negotiating with public for funds		• The construction of a community recreation center was found to be a solution for building community support for public education among a growing number of community residents w/out children
student/teacher interaction 3rd/4th grade children	trad. & open classroom settings		personal space	• Open classroom students reported smaller interpersonal distances to specific individuals than traditional classroom students.
impacts of technology on teaching & learning physical education, arts career, continuing ed, home	impacts of technology on the learning environment	impacts of tech on school building design & construction & on community planning		With the advent of technology: • the school will become a more integral part of community private business and government • Tech will advance the idea of individualized learning (Schedules will become customized computer assisted instruction & greater access to info) • Tech will promote design of smaller schools • chalkboards and projectors and tvs will be replaced • Tech will forge new links between home and school
	built-in flexibility great spaces innovative building materials energy conservation pitched and visible roofs climate/regional based planning constraints on urban school design specialized school buildings career education centers child-care centers, cont. ed.	recycled buildings additions/renovations designing for reuse		The author discusses changes in the physical form of schools based on a number of trends (21) in school design which are emerging from practice.
	historical review community schools education as multi-locational New trends			New trends (see his 21 trends) this article goes into more detail on describing these trends.
	New trends			This article elaborates on the author's "trends" discussion
		school program planning: replacing old with new school as community center expansion of existing site		School program planning is an opportunity for the community to express its commitment to education, and an opportunity to maximize the value of the institution for all citizens.
		Steps in facilities management		Describes the steps to be taken in a facility management process

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Dimensions of the Educational Environment: Social Dimension
24	California Department of Education, 1990	Architecture	Non-empirical analytical case studies	Both Physical setting & Organizational: Design implications of school reform	Methods of instruction services for children at risk of failure pre-school & before- and after-school care use of technology in curriculum & assessment year-round schooling	collegiality & professionalism among teachers community use of facilities parental involvement
25	de Carlo, 1975	Architecture	Non-empirical essay report	Temporal Dimension: Design of school bldgs	discusses the relationship between organizational goals & architecture	
26	Centra & Potter, 1980	Education	Review of the research	International model: school and teacher effects on student achievement	school district conditions within school conditions	
27	Chopra, 1991	Education	Non-empirical report	Physical setting: Financing construction of new school building	Elementary schools	Community politics
28	Christopher, 1992	Architecture	Non-empirical report	Physical setting: Architecture for education	educational philosophy and its link to architecture	
29	Cohen, Goodnight, Poag, Cohen, Nichol, & Worley, 1986	Environmental Psychology	Empirical questionnaires interviews	Personal	elementary school	
30	Colven, 1990a	Architecture	Empirical case study report	Temporal Dimension	pre-school nursery school	
31	Colven, 1990b	Architecture	Non-empirical report and case studies	Physical setting: how physical environment affects educational quality	Hidden curriculum	
32	Conners,1983	Education	Review of research	Personal: stress		
33	Cotterell, 1984	Environmental Psychology	Empirical: diaries	Personal	junior high school	
34	Crowe, 1990	Education/ Environmental Design	Design guideline report	Physical setting		

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
use of manipulative materials	school size modular/flexible schools	planning steps determining specs planning for quality		• Flexible classroom spaces necessary to accommodate various sized groups & multiple instructional methods • As students work with more materials, additional space will be necessary • Teachers need space to work together, classrooms will need to be larger to accommodate several teachers working with students • partnerships between school and community may change the design of schools • With different groups using the school, it will need to be designed to be open year-round and around the clock • Strong parental involvement will affect school design • Access to technology will vary widely & design will have to accommodate this variety
		discusses the whys of design before the hows		• The institutional school furnishes a limited education • The least suitable place in which to carry out educational activity is the school building since it closes off teaching & learning from contacts with the complex content of society. • Job of architect to outline the organizational structure which should realize educational activities in space.
student characteristics, achievement & behavior teacher characteristics, achievement & behavior				See article for a comprehensive structural model of school and teacher variables influencing student learning outcomes
		campaign for bond issue key supporters transfering leadership selecting architects educ specifications contractor selection		[JAL: a promotional piece without much substance]
	innovative school designs building as teacher friendly environments attention to detail, variety of exp. adequate space, flexibility, inspiring a sense of community			• most successful environments are friendly to users, feel at home and welcome through child scaled designs with color, texture and graphics • The building can be used as a teacher by expressing systems • Buildings should emulate the positives of their surrounding environmental context • Schools should provide a variety of spatial experiences
Individual: affective & cognitive effects of different spatial familiarization experiences	A school campus consisting of three buildings and a playground area			• Differences in attitudes towards academic, spatial security and social affairs in school occurred as a function of the spatial familiarization experiences.
		design and planning process		Why did process often fail to produce suitable solutions? Why did school premises often relate poorly to requirements Why did so many environmental problems & building performance failures occur? Problems with user participation and feedback, design and building management Measures for improving planning procedures presented
pupil perspective	whole school env. case studies are reviewed space becomes a place importance of social areas in schools	appropriation of space A/C relationship problems in planning process maintenance of quality	aspects of quality in school environments	• design of social areas allows small groups of students to meet giving a feeling of togetherness and relaxation • Streets and courtyards can act as social areas which can be used by teachers and students as well as facilitating integration with the community as a whole.
student's response to (env press) social interaction	activity nodes spatial organization seating position, classroom design & arrangement, density & crowding, and noise		stress wayfinding privacy	• Designed environments of schools may stress users of the facility both directly and indirectly, both school-wide and at the classroom level. • Schools must provide places which will enhance goals for interaction, for participation in social networks and control of time and place of social interactions. • physical env effects non-achievement behaviors and attitudes
student and teacher anxiety	open plan schools conventional school designs			• teachers i n open schools experience more tension & anxiety than teachers in conventional schools. • In open plan schools, transitions to new activities more frequent, and more prolonged and student off-task behavior was greater.
	Design elements which make school safer			Crime prevention through environmental design

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment Organizational Dimension	 Social Dimension
35	Crumpacker, 1992	Education	Empirical: ethnographic, interpretive & descriptive	Social: school culture	elementary school	multiple meanings of smallness home as a template for school feeling like family & support implications of shared space feelings of belonging school as a repository for cultural memories and lore.
36	David, 1981	Education	Review of the research	Physical setting: the Physical classroom environment	elementary schools preschool settings	
37	Day & Day, 1991	Education/ Environmental Design	Non-empirical report	Temporal Dimension		
38	Daly & Suite, 1981	Education	Empirical: observations interviews	Personal	preschool to secondary	
39	Dierdorff, 1989	Education	Non-empirical Essay report	Temporal Dimension	elementary & secondary schools	
40	Dunwoody, 1988	Architecture	Non-empirical report	Temporal Dimension		
41	Edwards, 1991	Education/ Public Policy	Empirical	Physical setting	Public school system	
42	Elias & Elias, 1976	Education	Empirical	Physical setting	elementary school	
43	Englehardt, 1988	Educational facility management	Empirical survey design	Physical setting		
44	Evans, Kliewer & Martin, 1991	Environmental Psychology	Review of empirical research	Physical environment and Personal		
45	Evans & Lovell, 1979	Environmental Psychology	Empirical research	Temporal Dimension: design modification		
46	Fisher, 1975	Environmental Psychology	Empirical research: interview observation self-reports	Physical setting/ Personal	elementary schools program openness language arts instruction	
47	Fraser & Fisher, 1981	Environmental Psychology	Empirical research: questionnaires tests	Physical setting/ Personal	33 junior high schools program openness	

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
experience of comfort signif of ambient sensory info factors leading to feelings of safety and security	artifacts of a school facility	Implications are drawn for architects & school facility planners		• generally, a school facility which worked facilitated interaction among people was easy-to-read, had long unbroken visual lines lacked an institutional feel was the embodiment of the community contained constructs which users defined & adapted as homelike offered a safe, secure environment had a place to congregate, had activity options for users was compact, but adaptable contained no off limit places was never pierced by the amplified noise of an intercom system
student achievement	open plan vs conventional argument			Primarily a review of research on open classrooms
		hiring consultants		
classroom seating choice teachers perceptions of students	traditional classroom setting			• Students in front of classroom viewed more favorably by teachers • Teachers regard males sitting in rear and females in front more positively in early grades & negative in later grades • Teacher social-communicative anxiety affects evaluations based upon seating choice.
		Designing for behavior life-cycle costing developing program specifications Equip. & furnishings		Article describes the process for administrators
		designing schools with maintenance in mind		
Student achievement	building conditions broadly defined	parental involvement		• Research looks at the impact of parental involvement on the overall condition of school buildings; then looks at impact of variables on student achievement. • Capital outlays to improve basic conditions of schools may contribute to students' achievement.
student curiosity and openmindedness	open classroom			open classrooms may encourage some aspects of curiosity to a greater extent than does the traditional classroom
	Science classrooms			evidence of spatial influence on science teaching
health and well-being of children	crowding, pollutants, noise and architectural design elements pathogenic conditions, stimulation levels, functional complexity, control, structure and predictability exploration		environmental stress	
interruptions substantive questioning process questioning	open-plan school	Design modifications: addition of variable height partitions		Following design modifications of the school's open classrooms, substantive, content questioning increased, classroom interruptions decreased, while non-substantive questioning remained the same.
Student behavior variables (activities, social group size) Teacher behavior variables	self-contained instructional areas seen as "closed space" architecture vs "open space" architecture			• teachers in open programs engage fewer students & consulted w/ small groups of students than teachers of less open programs • Program openness is a useful dimension upon which to distinguish among educational environments.
Student achievement & attitudes	"closed space" architecture vs "open space" architecture			• Actual openness accounted for a substantial and significant amount of the variance in affective but not cognitive achievement

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment Organizational Dimension	Social Dimension
48	Fulks, 1985	Education	Non-empirical essay	Physical setting	junior high & middle schools	
49	Garbarino, 1980	Education	Review of empirical studies	Physical setting	secondary schools	
50	Genervro, 1990	Architecture	Non-empirical case study report	Physical setting	elementary and secondary urban schools school reform issues	
51	Goldberger, 1990	Architecture	Non-empirical report	Physical setting	elementary and secondary urban schools school reform issues	
52	Goldberg & Bee, 1991	Education	Non-empirical report	Temporal Dimension	elementary and secondary urban schools school reform issues: school-based management assessment strategies	
53	Goleman, 1992	Education	Non-empirical report	Temporal Dimension	school play areas	
54	Gump, 1974	Environmental Psychology	Empirical	Physical setting	primary and intermediate school grades open education	
55	Gump, 1978	Environmental Psychology	Review of empirical research	Physical setting	preschool, K-12, college	
56	Gump, 1987	Environmental Psychology	Review of empirical research	Physical setting	preschool, K-12, college "program units"	
57	Gump & Good, 1976	Environmental Psychology	Empirical observations interviews	Physical setting	primary and intermediate school grades open education	
58	Ross & Gump, 1979	Environmental Psychology	Empirical observations interviews questionnaires	Physical setting	19 elementary schools	

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
	Interior design elements: furnishings, walls, hallways	Students involved in interior design of their classrooms		• Classrooms and hallways should abound with mobiles, posters art productions, displays, plants, etc./ reflect kid's interests in TV movies, music, etc./ learning centers/ flexible seating arrange/ movable space dividers, portable chalkboards/ shelving/ maps • This env should reflect interest , desires and needs of children
adolescent development	School size			1. school size matters particularly to academically marginal students 2. school size is not a simple linear effect but involves a threshold effect so that increases above 500 (in secondary schools) do not have appreciable effect. 3. recent trends indicate that many schools are beyond size forcing larger numbers of marginal students into these schools
	school size school design			• Schools should respect students and teachers as individuals, have warmth (spacious, bright, inviting) , have security and flexibility. • A classroom "suite" (2 teacher offices, small-group mt'g rm w/ kit & 2 classrms) would foster relationships & sense of being & belonging to a particular place. • Image of "house" to less perceived scale of schools. • "House plans" similar to suite.
	school size multiple learning spaces	collaborative design processes		A review of the Genervro article • Trends towards multiple spaces for various learning styles ("intelligences") • shared decision-making will change collaborative processes
		processes of design with children		Chilren's environments research group in CUNY
individual student behavior	open vs traditional design schools			Open design provides easy access to various facilities and persons. increases nonsubstance time, provides for flexibility in grouping, is more active and stimulating than traditional. Differences are slight at intermediate levels, but more pronounced at primary level.
student and teacher behavior and attitudes student achievement	size and density open school environments			see review for various hypotheses all based on Gump's ecological theory
student and teacher behavior and attitudes student achievement "participant action" psychosocial questionnaires	size and density open school environments spatial patterns & paths classroom seating school objects			see review for various hypotheses all based on Gump's ecological theory
individual student behavior	open vs traditional design schools problems with open designs			Non-substance time could be reduced by designing "anchor places" near teacher areas; changing program by requiring less site changes; provide a "noisy room".
		design modifications which lead to more open designs		Study explores questions of original design openness, modified design openness, program openness, teacher-reported advantages and disadvantages, and factors involved in facilitating or inhibiting an open program 1. open physical design most suited for open programs 2. persisting forces tend to push away from the open arrangement toward simpler organization (one less dependent on cooperative teacher effort). 3. training required of teachers to maintain open education over traditional forms of instruction

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
59	Gump & Ross, 1977	Environmental Psychology	Essay on empirical research	Physical setting	elementary school	
60	Gump & Ross, 1978	Environmental Psychology	Essay on empirical research	Physical setting	elementary school	
61	Hart, 1987	Environmental Psychology	Non-empirical essay	Personal/ Temporal Dimensions	pre-school & elementary school	
62	Heddens, 1981	Education	Historical review & Review of empirical research	Physical environment	Elementary education	
63	Herman, 1990	Education	Non-empirical report	Organizational Institution	Educational specifications for building or remodeling schools	
64	Herman, 1991	Education	Non-empirical report	Temporal Dimension:		
65	Hertz, 1990	Education	Non-empirical report	Temporal Dimension		
66	Hill, 1990	Architecture	Non-empirical report	Temporal Dimension		
67	Hoag & Johnson, 1975	Environmental	Empirical	Physical setting	elementary schools	
67	Hoag & Johnson, 1975	Design				
68	Holt, 1975	Environmental Design	Non-empirical report	Temporal Dimension		
69	Horowitz & Otto, 1973	Education	Empirical	Physical setting	college english course	

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
individual behavior of students and teachers	open/traditional classroom designs			Paper argues for the study of school environments as clusters of synomorphs
	measures of openness in elementary school classrooms			The paper argues for the careful measurement of designed and modified openness in classrooms (openness quotient)
child development social and psychological benefits	Playground design	involvement of children in design		Article presents the argument for child participation: all should have the opportunity to participate
	open space schools seating & furniture arrangement windowless classrooms noise			This article is a general review from the encyclopedia of education may be a nice piece to review the history of elementary school education
	elements of school design as they relate to educ specs			If educators complete a comprehensive set of educ specs, the pysical plant will enhance the instructional and support programs to be offered within it.
		planning a new or remodeled school building		Establish the need, involve many people, do detailed planning, market it well, monitor the entire process, sell what it will do for students, hire experts when needed, avoid minefields, and let the community enjoy and be proud of the finished product.
		reflections on a building program		Importance of construction manager, meeting the construction deadline, involvement of staff, visits to the sites, roles of the superintendent
	Energy conservation through daylighting	design guidelines for daylighting		The article presents some basic design principles for daylighting in schools.
	open vs traditional classrooms			Article presents (I think) a comparative study of open and traditional classrooms as a pilot study for a larger study
		Involvement of users in school planning: users represented on teams delphi technique mobilizing community feelings open-forum planning (CRS) team approach		
student performance, behavior	"alternative" classroom env vs. traditional row/column classrm			No significant differences found in grades earned by students, however, participation, disagreement with the instructor and openness to criticism by peers more evident in experimental over controlled one.

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
70	Hoy, 1980	Education	Empirical: survey	Personal	Secondary schools	
71	Ingalls, 1986	Architecture	Non-empirical report	Temporal Dimension	educational philosophies and educational programs	
72	Interface Project, 1990	Education	Non-empirical position paper	Physical Setting	educational reform issues	
73	Jordan, 1991	Education	Non-empirical case study report	Temporal Dimension	K-12	Issues of community support
74	Kaplan, 1992	Architecture	Non-empirical report	Temporal Dimension	Elementary school	
75	King, 1990	Education	Non-empirical case study report	Organizational: Curriculum & Instruction	Instructional technologies School reform issues	
76	Kurent & Olson, 1990	Architecture	Non-empirical report	Physical setting		community support (taxes)
77	Le, 1989	Facility management	Non-empirical case study report	Physical setting		
78	Lundquest, Dunekack, Falling, 1991	Education	Non-empirical case study report	Physical setting	Middle school science instruction	
79a	MacPherson, 1984	Environmental Psychology	Empirical	Physical setting/ Personal	Australian high school	Spatial patterns of classroom interaction
79b	Marcus, Whyman, Morgan, Whitton, Maver, Canter & Fleming, 1972	Architecture	Empirical research	Whole system		
80	McKee & Witt, 1990	Education	Review of empirical research	Physical setting (Organization)	classroom organization and management Instruction	
81	McKinley, 1991a	Architecture	Non-empirical report	Temporal Dimension		

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
Student and teacher attitudes	open and traditional classrooms			• Architectural design did not contribute significantly to differences in attitudes of students and teachers • There was a trend toward positive attitudes for teachers in open plan schools, and trend toward positive attidues for students in traditional plan schools
		program/ planning		Article presents a guide for bridging educational philosophy with educational specifications and facility planning
	school facility as a whole			Article presents the National Interface Taskforce's explorative study on the interface between school facility and student learning.
		Design and construction of a renovation project		Article gives a description of the process of renovation of an existing school.
		Design of school for student needs, teaching methods, building		This article describes one architect's interpretation of CRS's "squatter sessions" as a means to building consensus "Flexibility" is also a key word for design of schools
				Article describes the Saturn School of Tommorrow in St.Paul Minnesota. This would be a good case study for my directed research project next semester. Address to send for more information/ also get name of educational consultant that Teflon Man worked with/ and look his school
	need for more space/ flexibility modular buildings			Report discusses architectural related concerns for learning env: budget pressures, global competitiveness, information revolution, building boom, changing functions of schools,individualized and cooperative learning, focus on indoor env quality, energy efficiency
	Convertable school (adaptive reuse designed)			School designed to be adaptively reused in the future for a 18 unit self-contained apartment facility for senior citizens.
	technology lab: multi-purpose spaces, visually open spaces, modular organization, student-centered class management			Article presents floor plans of five lab designs for middle & high schools
Student definitions of the classroom: control over classmates/teachers, socio-bility, academic commitment	row and column classroom settings			• Row/column classroom increases teachers' problems of control: front and back row student behavior varies (ie students who choose a dominate social role in the classroom sit further away from the teacher • Study emphasizes student perceptions of classroom over teacher
	Seating position Classroom design & furniture arr. Spatial density and crowding noise, lighting			This book section is a review of instructional and environmental variables in the classroom. A structural model is presented of school & teacher variables which influence student learning outcomes (Centra & Potter 1980)
		Programming Gaming		Article stresses the importance of programming as a way of making sure each new school facility is as close to what the school district expected.

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
82	McKinley, 1991b	Architecture	Non-empirical report	Temporal Dimension		
83	McKinley, 1992	Architecture	Non-empirical case study report	Temporal Dimension		
84	Mendelson, 1992	Architecture	Non-empirical report	Physical setting		
85	Midjaas, 1981	Education	Review of literature	Physical setting		
86	Murphy, 1991	Architecture	Non-empirical Case studies	Physical setting		
87	NYSSBA, 1989	Education	Non-empirical report	Temporal		school boards
88	Pearson, 1991	Architecture	Non-empirical Case study report	Temporal		
89	Pellegrini, 1987	Environmental Psychology	Review of empirical research	Physical setting/ Personal	pre-school	
90	Pesanelli, 1990	Education	Non-empirical report	Physical setting		
91	Proshansky & Wolfe, 1975	Environmental Psychology	Essay based on empirical work	Temporal/ Physical setting	elementary school open education	
92	Riesslbach, 1990	Architecture	Non-empirical historic report	Temporal/ Physical setting		
93	Rist, 1990a	Education	Non-empirical case study report	Physical setting	Middle school	
94	Rist, 1990b	Education	Non-empirical case study report	Physical setting	High school	

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
		Construction manager vs general contractor		Article emphasizes the advantages and disadvantages of both traditional and CM approaches
		project staging strategy		The decision to plan two schools on one site as a response to changing demographics of the school district is explained.
	Integrated Information System in a centralized network			
	EBS relations Plant construction Trends in facility design	planning process		This article is a review of the "school plant and facilities" from the enclyclopedia of Educ Research [may be good just to review this article for its critical review]
	Case studies of completed designs			Good source for future case studies
		facilities planning, design and management		Long-range planning is critical, should be used to develop a vision but also respond to several larger trends (8 are mentioned) Artical addresses school boards
		getting communities involved keeping child's size in mind		A short article/essay about school design
playground behavior	playground design			
	playgrounds, parks, bus stops			Playgrounds, parks, and bus stops can be ideal places for "classrooms without walls"
	open vs traditional classrooms	planning of classrooms		The authors emphasize the process of planning and the questions involved in that process. Practitioners should put more thought into the planning and arranging of their classrooms. They have developed a framework for doing this, instead of a solution to a problem.
	school designs	History of public school design in NYC		
	color schemes for school wide light-filled corridors outdoor walkways seating areas primary colors foster lively atmosphere			
	two story student commons created in renovation by filling in an existing courtyard cafeteria modeled after fast food restaurants in malls			

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
95	Rivlin & Rothenberg, 1976	Environmental Psychology	Empirical	Physical setting	2 elementary schools open education	patterns of use
96	Rivlin, Rothenberg, Justa, Wallis and Wheeler, 1974	Environmental Psychology	Empirical	Personal	2 elementary schools open education	
97	Rothenberg, 1989	Education	Review of the empirical research	Physical setting	open education philosophy	
98	Rydeen, 1991	Architecture	Non-empirical report	Physical setting	K-12	
98	Rydeen, 1991 (continued)					
99	Sanoff & Barbour, 1975	Environmental Design	Non-empirical case study report	Temporal Dimension	Alternative school	
100	Sebba, 1986	Environmental Psychology	Non-empirical: essay based on empirical support	Temporal Dimension		
101	Sheat & Beer, 1989	Environmental Design	Empirical Case Study	Temporal Dimension		
102	Smith, 1990	Education	Non-empirical case study report	Physical setting		
103	Sonnier, 1981	Education	Review of empirical research	Physical setting	open education	
104	Stanard, 1989	Facility Management	Non-empirical report	Physical setting		
105	Stuebing, Knox, Petrakaki & Giddings (1991)	Architecture	Empirical	Temporal/ Physical setting	elementary school teaching modes Apple Classrooms of Tommorrow (ACOT) Longitudinal Research Centers	

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
student and teacher behavior and attitudes	a variety of open classrooms & furniture arrangements			• Even with freedom to move furniture the researchers found layouts to be relatively stable over the period of study. • There was much individual work despite value expressed for group work • Questions are raised as to the meanings of "open" to teachers • Uneven use of classroom space • open classrooms evolve from earlier stated goals until it settles on some static form of comfort to the teacher where an integration between setting and educational activities results
children's perceptions of open classrooms via scale models	open classroom			• children able to translate their images of the room to the model • Children could answer questions using the model • there were stylistic differences in children's descriptions
	open classroom			The article is a good summary of the research which has been done on the open classroom.
	school size			school size is growing, reasons are listed. • changes in technology has increased library into a media center • windows in every classroom increases circulation to those rooms • Special education requirements • gyms have increased in size; girls athletics programs • house concept adds space • special art, science and music rooms
		planning with children in charrettes		Authors describe a structured charrette process by which participants came to define their educational goals and program as implications for design.
impact of physical environment on child development		social implications of various design approaches		
environmental learning experience for students		user participatory design methodology		participation not only holds great potential as a means of producing a design, but also as an environmental learning experience in itself for users and designers
	Technology: Hypermedia			
	open classroom			Contains an interesting categorization of teaching modes, types of teaching objectives and quality of teaching objectives
	"Distance Education" (technology)			Article describes then discusses the implications of "Distance Learning Systems (DLS) which are a collective name for sending instructional materials via telephone, fax or other future communication mediums to students in other geographic areas.
teacher attitudes	learning technologies	design modifications of		• More space required for tech-rich classrooms
observation of student and teacher behavior		existing classrooms		• mode of teaching can alter design requirements of classroom • interactive technologies do not necessarily increase flexibility • design & arrangement of furniture needs further development to adpaft to interactive technologies • comfort and climate needs heightened with intro of tech

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
105	(continued)					
106	Stuebing, Giddings & Cousineau, 1992	Architecture	Empirical	Physical setting	K-12 Apple Classrooms of Tommorrow (ACOT) Longitudinal Research Centers	
107	Sutner, 1991	Architecture	Non-empirical report	Physical setting		
108	Taylor, 1992	Architecture	Non-empirical report	Physical setting	Headstart classrooms of the future	
109	Traub, Weiss, Fisher & Musella, 1972	Education	Empirical	Organizational	open education	
110	Vasilakis, 1990	Education	Non-empirical report	Temporal		
111	Wachs, 1987	Developmental Psychology	Non-empirical: theoretical perspectives	Personal/ Physical setting		
112	Walters, 1992	Architecture	Non-empirical case study report	Physical setting		
113	Weinstein, 1977	Education	Empirical	Personal/ Physical setting	2nd and 3rd grade open education	spatial distribution of activity
114	Weinstein, 1979	Education	Review of empirical research	Physical setting		
115	Weinstein, 1980	Education	Non-empirical: design guide	Temporal	instructional program	
116	Weinstein, 1981	Education	non-empirical: design guide	Physical setting		
117	Weinstein & David, 1987	Developmental Psychology	Non-empirical: theoretical perspective	Physical setting		

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
				• servicing and networking problems • needs fo storage greatly increased.
teacher attitudes observation of student and teacher behavior	Impact of technology on the physical environment			• teachers should be given support to better understand classrooms • Embedded beliefs can limit possibilities for change • Change in env fosters change in teaching and learning & encourage collaborative work. • Tech rich classroom requires greater architectural consideration whether retrofit or new construction.
student performance	building conditions			This article from the Washington Post is a summary of Edwards study of building conditions
	pavilion designs for classrooms			Not sure whats going on with this one. I know she is into environmental education
				teacher questionnaire (Dimensions in Schooling DISC) Unless I start getting into open education research, this article is too detailed for my use at this time.
		Master Planning		Facilities planning is required more than every considering all the changes occuring now and into the future. The article presents the case for school districts considering short and long-term planning
child development	environment broadly defined			The author states the case for the developmental perspective along side of the educational, architectural and environmental psychologist. Theoretical in nature
	Prototypical designs for NYC			Playful design breaking the mold of institutional looking architecture Prototypical floor plan designs for 1st and 2nd grade classrooms called "The Jolt": offset designs which create flexible spaces
student behavior	Open classroom			Minor changes in the physical setting produce predicable, desirable changes in student behavior.
student attitudes, behavior and achievement teacher attitudes & behavior	seating position classroom design density, privacy, noise windowlessness open space school designs			See article for a comprehensive set of conclusions concerning the literature on the physical environment of the school.
student behavior		Designing classroom environments		Teachers generally do not consider the environment as a variable that can affect student behavior. Teachers often seek interpersonal or pedagogical explanations for undesirable behavior when a relatively simple problem w/ the classroom's physical arrangement is responsible. Article presents principles for design and management of classroom
	classroom design & arrangement classrooms organized by function aesthetics			
				1. Built envs have both direct and symbolic impacts on children 2. Study of the built env & child's development will benefit from a multisetting perspective 3.All envs for children should serve a certain common functions with respect to child development: to provide opportunities for

No.	Source	Disciplinary Orientation	Methodology/ Approach	Principal Dimension	Dimensions of the Educational Environment: Organizational Dimension	Social Dimension
117	Weinstein & David, 1987					
118	Morrow & Weinstein, 1982	Education	Empirical	Personal	kindergarten school literature program	
119	Weinstein & Pinciotti, 1988	Education	Empirical	Temporal Dimension/ Physical setting	K-3	
120	Weinstein & Woolfolk, 1981	Education	Review of empirical research	Physical settings		
121	Westbrook, 1988	Education	Non-empirical case study report	Temporal Dimension	School system	
122	Wintrowski, Gottfredson & Roberts, 1983	Environmental Psychology	Empirical	Personal	Secondary schools: 321 junior high schools 321 senior high schools urban/suburban schools	school disruption behaviors
123	Winett, Battersby & Edwards, 1975	Education	Empirical	Physical setting/ Organizational/ Social	sixth-grade classroom individualized instruction math and language period	group contingencies social behavior child-teacher interactions
124	Wolfe, 1986	Environmental Psychology	Historical review	Organizational/ Social (Whole system?)	institutional expectations control and authority	children's socialization
125	Wolfe & Rivlin, 1987	Environmental Psychology	Review of empirical research	Organizational/ Social	stated goals administrative, educational therapeutic programs contextual env (pol, econ, social)	children's socialization
126	Yelland, 1990	Architecture	Non-empirical report	Temporal		
127	Zifferblatt, 1972	Education	Non-empirical essay	Physical Setting		
128	Zimring & Barnes, 1987	Environmental Sociology	Non-empirical: methodological and theoretical essay	Physical setting/ Temporal		

Personal Dimension	Physical Dimension	Temporal Dimension	Interactions/ Attributes	Outcomes
				growth, promote a sense of security and trust, to allow both social interaction and privacy. 4. There are substantial individual and cultural variations in the use and interpretation of settings care environments (adults needs must be met as well).
children's use of literature	control and experimental setting			Without a well designed library corner, few children chose to read literature as a free-play activity.
child behavior parent's and designer's goals for playground	tire playground	Design of playground		construction of playground led to significant decreases in organized games, uninvolved behavior, and roughhousing, and significant increases in active play and pretend play.
child impression formation	classroom design			classroom design could be seen as a teacher's nonverbal statement about that teacher and could effect child impression formation. Environmental factors may communicate messages about teachers' and students' behavior.
		Decision-making in planning and design of Illinois Public School Facilities		factors which influence decision-making are ranked in importance It is assumed that education professionals differ according to their occupational orientation.
				Goal to construct a "crude map of the school social terrain" Moos' scales
academic work outcomes				Individualized instruction with group contingencies increased academic production of children at all levels of ability, improved social behavior, changed teacher mode of instruction & interaction Individualized instruction alone had lesser effects, while architectural changes produced no significant changes in the academic or social behavior of children or teacher behaviors.
				Because institutions are resistant to change, children should be given projects that empower change in themselves.
				Similar to Wolfe, 1986
		managing the public investment of educational facilities		
Student behavior Teacher behavior	classroom arrangements			Article is an introduction to the relationship between architecture and behavior by the use of some examples. (may be a useful document for future descriptions of the relation between architecture and behavior in classrooms)
				content issues: who and what are being studied?
				Methodological issues Ways of defining settings * suggestions for further research * implications for design

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