"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.

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).

See the Appendix: Annotated Bibliography for further analysis of this body of literature.
<table>
<thead>
<tr>
<th>Dimensional Interactions &amp; Topic</th>
<th>Educational Psychology</th>
<th>Environmental Psychology</th>
<th>Environmental Design Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social/Organizational/Personal Dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational Development</td>
<td>Rowan, 1990</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom Management</td>
<td>Anderson, et al., 1979</td>
<td>Brophy, 1983</td>
<td></td>
</tr>
<tr>
<td>School Climate</td>
<td>Anderson, 1982</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programs &amp; Services Evaluation</td>
<td>Illlich, et al., 1990</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Education</td>
<td>Stansfield &amp; Earl, 1983</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Size</td>
<td>Glass et al., 1982</td>
<td>Miner, 1992</td>
<td>Bourke, 1986</td>
</tr>
<tr>
<td>Teacher-Student Interactions</td>
<td>Gump, 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructional Methods</td>
<td>Gump, 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person/Physical Dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom Furnishings Arrangement</td>
<td>Winett, et al., 1975</td>
<td></td>
<td>Gump, 1979</td>
</tr>
<tr>
<td></td>
<td>Loughlin &amp; Sata, 1982</td>
<td></td>
<td>King &amp; Maree, 1979</td>
</tr>
<tr>
<td>Spatial Density, Crowding &amp; Space</td>
<td>Pagot, 1977</td>
<td></td>
<td>Corners, 1983</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zimring, 1981</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Loo, 1976</td>
</tr>
<tr>
<td>Seating Position</td>
<td>Daly &amp; Suite, 1982</td>
<td></td>
<td>Adams &amp; Biddle, 1970</td>
</tr>
<tr>
<td></td>
<td>Schwaab &amp; Charter, 1972</td>
<td></td>
<td>Kornya, 1976</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MacPherson, 1984</td>
</tr>
<tr>
<td></td>
<td>Chessen &amp; Doyley, 1976</td>
<td></td>
<td>King &amp; Maree, 1979</td>
</tr>
<tr>
<td></td>
<td>Downing &amp; Rainsow, 1979</td>
<td></td>
<td>Brunetti, 1972</td>
</tr>
<tr>
<td></td>
<td>Warneken, 1977</td>
<td></td>
<td>Correll, 1974</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evans &amp; Lovel, 1979</td>
</tr>
<tr>
<td>Class Size</td>
<td>Gump, 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privacy</td>
<td>Mosca, 1979</td>
<td>Mace, 1976</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brunetti, 1972</td>
<td>Ahrens &amp; Evans, 1984</td>
</tr>
<tr>
<td>Noise &amp; Acoustics</td>
<td>King &amp; Maree, 1979</td>
<td>Warneken, 1979</td>
<td></td>
</tr>
<tr>
<td>Climate &amp; Thermal Comfort</td>
<td>King &amp; Maree, 1979</td>
<td>Humphreys, 1979</td>
<td></td>
</tr>
<tr>
<td>Windowless Classrooms</td>
<td>Warneken, 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilation</td>
<td>Zabol, 1976</td>
<td></td>
<td>Taylor &amp; Vlastos, 1975</td>
</tr>
<tr>
<td>Play yards</td>
<td></td>
<td></td>
<td>David &amp; Wright, 1975</td>
</tr>
<tr>
<td>Child Development</td>
<td></td>
<td></td>
<td>Sibbe, 1986</td>
</tr>
<tr>
<td>Physical/Socio-Organizational Dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Program/Design</td>
<td></td>
<td></td>
<td>Gump &amp; Good, 1976</td>
</tr>
<tr>
<td>Correspondence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Classrooms</td>
<td>Molloy et al., 1972</td>
<td></td>
<td>Gross &amp; Murphy, 1968</td>
</tr>
<tr>
<td>Educational Facility Development Process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hill, 1984</td>
<td>Herman, 1980</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hebb, 1980</td>
<td>Dierendorf, 1980</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dey, 1985</td>
<td>Bille &amp; Lavis, 1989</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ahrens &amp; Evans, 1988</td>
<td>Caudill, 1978</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bunstake, 1988</td>
<td>Geykard, 1988</td>
<td></td>
</tr>
<tr>
<td>Participatory Design</td>
<td>David &amp; Wright, 1975</td>
<td>Taylor &amp; Vlastos, 1975</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sibbe, 1994</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Management</td>
<td>David &amp; Wright, 1975</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td>Earthman, 1985</td>
<td>Hawkins &amp; Libby, 1986</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Studies</td>
<td>Sibbe, 1994</td>
<td>Molloy et al., 1972</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bunstake, 1991</td>
<td>Ranney &amp; Rysdon, 1989</td>
</tr>
<tr>
<td>Non-classroom Learning Settings</td>
<td>David &amp; Wright, 1975</td>
<td></td>
<td>Pidcock, 1988</td>
</tr>
<tr>
<td>School Play yards</td>
<td>David &amp; Wright, 1975</td>
<td></td>
<td>Evans, 1984</td>
</tr>
<tr>
<td>Environmental Awareness</td>
<td>David &amp; Wright, 1975</td>
<td></td>
<td>Taylor &amp; Vlastos, 1975</td>
</tr>
<tr>
<td>Community Schools</td>
<td>David &amp; Wright, 1975</td>
<td></td>
<td>Sibbe, 1975</td>
</tr>
</tbody>
</table>

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 (Illick, 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 & Suiia, 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 management 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-iness 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 aspirations, 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 possibility 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 primarily 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 their 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 children 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 sitting closer to the front were regarded more favorably than those sitting 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 likeable 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 building 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 (Eathman, 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 participation 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 number 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 classroom 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).

Classroom 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 experimental studies primarily 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 tendency 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 earlier 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 preferred 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 effects 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 opportunities 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 positively 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 "synomorph" 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 arrangements 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 maintained an 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 facility 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 interpret 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, Dier dorff (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; expandable 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 facilities, 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 tangible 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 outreach 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. Gaylaired (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, evaluation 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 integrated 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 boundaries 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 encompassing 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.

The subsequent section will continue to 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 historic analysis can help provide some insights into how these three disciplines could be integrated into a larger multidisciplinary approach.
BIBLIOGRAPHY

EDUCATIONAL PSYCHOLOGY RESEARCH


ENVIRONMENTAL PSYCHOLOGY RESEARCH


ENVIRONMENTAL DESIGN RESEARCH


