

CHAPTER 4

GIVING FORM TO EMERGING EDUCATIONAL CONCEPTS: RESPONDING TO THE ENVIRONMENT-BEHAVIOR LITERATURE⁹

School districts and school boards across the United States are debating the merits of improving the infrastructure of schools in their districts. Should money be spent on rehabilitating turn-of-the-century buildings and on deferred maintenance? Or should money be spent on new facilities? If school buildings are renovated, or new ones built, can they be more responsive to new ideas in education? Can they aid improvement of instruction and the improvement of academic performance?

In the June 1992 *AASA Leadership News*, the first of us (GTM) was quoted as saying "... school designers and planners can give form to emerging educational concepts." The quote was accurate and correct. We would now like to expand on this view. There are, as the article continued, "... a number of ways ..." in which architects and other designers can give form to emerging educational concepts.

Patterns and Design Guidelines

We see two different ways to approach this issue: the development of patterns¹⁰ and design guidelines based either on the translation of empirical research (the subject of this chapter) or on extrapolations from educational reform ideas in combination with the practical experience of educators (the subject of the next chapter).

The first way is to "translate" findings from the empirical research literature on the effects of school buildings on educational performance into research-based design guidelines, patterns, or design principles (all of which will be taken here to be roughly equivalent), and then work to implement those design guidelines in new and renovated school building projects. This is an inductive, inferential, inherently creative process, and is the subject of this chapter.

The second, and still acceptable way--if it is done with humility and caution--is to extrapolate from educational reform ideas and the experience of reflective educators in

⁹ This chapter is based on parts of a keynote talk given at the Wingspread/Prairie School National Conference on Architecture and Education, Racine, Wisconsin, June 1992.

¹⁰ The notion of design patterns is based on the work of Christopher Alexander and his colleagues (Alexander, Ishikawa, & Silverstein, 1977). A *pattern* is a structural configuration, the core of the solution to a problem that occurs over and over again in the environment. As Alexander et al. say, it "describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" (p. x).

order to give these ideas architectural form. What we mean by this is to take an educational idea--like the notion of site-based management--and ask what characteristics, if any, of buildings *might* assist in achieving this idea. Assuming for the moment that it is a good idea, what characteristics of the physical, designed environment of the school might make it easier to achieve the idea of site-based management? It's like setting a stage for a play. The stage won't guarantee that the play will be a critical success, but it very likely will help; it will likely increase the probability of success. In the absence of conclusive empirical evidence, we cannot say such inductive architectural principles *will* for sure improve performance, only that they *might*. Thus this second way of giving form to emerging educational concepts is also very much an inductive process resulting also in working hypotheses. It is the subject of the Chapter 5.

In either case--translation of research or extrapolations from educational reform and reflective practitioner's experience--the important kernel, the structural core of the idea, can be called a *pattern*. We have been involved in developing a set of design patterns that translate existing empirical data into architectural form, and, where there is no empirical data yet, interpreting educational reform ideas and creating working hypotheses about other aspects of architectural form. Scientifically, the patterns are working hypotheses, subject to further scrutiny, documentation, and, most especially scientific test through attempted falsifications.¹¹

The General Method for Developing Patterns

Our approach in this and previous work,¹² has been, first, to review empirical literature identifying reliable findings about the impacts of the designed environment on educational performance (e.g., teacher attitudes, student attitudes and behavior, and student achievement). The educational and environment-behavior (EB) research literatures have over the years dealt with the concerns of the physical environment and its relationship to educational program effectiveness.

For example, as discussed in some detail earlier, an excellent review of the research on the physical environment of the schools was published by Carol Weinstein in the 1979 *Review of Educational Research*. As shown above, however, only part of what Weinstein concluded in 1979, however, is still true: "When classrooms varying in terms of furniture arrangement, aesthetic appeal, and the presence or absence of windows are compared, differences in achievement are nonsignificant.... On the other hand, there is considerable

¹¹ For an example of how to test patterns scientifically through quasi-experimental research methods, see Moore (1986).

¹² The reader is referred to the series of monographs, technical manuals, and papers on child care listed in *Publications in Architecture and Urban Planning Research* and in "Publications and Papers on Children and the Designed Environment" available from the UW-Milwaukee Center for Architecture and Urban Planning Research.

evidence that the classroom environment can affect *nonachievement* behaviors and attitudes" (her emphasis, meaning secondary measures of student and teacher attitudes and behavior, like decreased social interaction or increased aggression). While there is still strong evidence for the effects of school buildings on nonachievement behaviors and attitudes, there is newer and what we would call incontrovertible evidence that at least four critical architectural variables directly and indirectly effect educational achievement.¹³ Several areas of research continue to be productive, such as the impacts of classroom size and overall school size on performance (e.g., the Tennessee STAR study), while new research has emerged on the importance of the spatial definition of activity spaces. But there are a myriad of other topics and issues dealing with the physical environment of the school which are not being addressed by the educational or EB literatures.

Second, the architectural literature was reviewed and analyzed,¹⁴ looking at a range of educational facilities. A total of 100 school buildings from the US, Canada, England, and elsewhere in Europe were included in the analysis. These were the best examples of award-winning school designs in the 1980s and early 1990s. A wide variety of formal architectural designs and ideas emerged, which have been tried over and over again in different locations, and seem to have passed the test of time.

This type of analysis could be construed as subjective and biased by prevailing trends. The experience of design inquiry by successful architectural practitioners should not be so quickly dismissed. From the collective experience gained by designing educational facilities, architects and school administrators have found that certain architectural design patterns work better educationally than others. But for the purposes of this chapter, the rationale for searching and collecting design examples from the architectural literature was to find particular building designs that can serve to exemplify the patterns derived from the interpretation and translation of the empirical literature.

Numerous school buildings have been published in the architectural press, but with infrequent critical commentary. Many buildings appear to exhibit friendly and non-institutional designs. For instance, the massing has been broken down into residential building-scaled forms, with sloped roofs, open and operable windows, and intimate spaces inside. In some cases, corridors have become indoor "streets" for incidental socializing and unstructured teaching. But the commentaries in the architectural press, where they exist at all, address only the uniqueness of the design of these schools, and whether the design evokes picturesque or excessively post-modern images (such as polychromatic brickwork,

¹³ For another review of the evidence, see "Blueprints for school success" in *Rethinking Schools* (Moore & Lackney, 1993). See also Chapter 2.

¹⁴ Though this chapter focuses on responding to the EB literature, the process of deriving the patterns is generic, and is presented here. For case study examples of working with other than the empirical EB literature, e.g., the educational reform literature, please see Chapter 5.

intricate stucco details, bell and clock towers, etc.), not whether they lead to better teaching/learning environments for the users nor whether they have any impact on educational performance.¹⁵ In addition, there has been no empirical literature on the myriad of other design decisions which a responsible architect has to make in the course of designing, renovating, or expanding a school building.

In addition, third, we studied some of the educational reform literature. Our analysis here was looking for possible implications for the design of educational facilities. Questions raised by this analysis included: How will shared decision-making impact facility layout of classrooms or whole school buildings? What is the implication of new forms of assessment, such as portfolios, on the use of classroom space? How will the process of furthering the professionalization of the teaching profession impact the privacy needs of teachers? The relationship between school design and educational reform is only beginning to be addressed. Several patterns identified here are based on the ground-breaking work of the California Department of Education in their 1990 publication *Schools for the Twenty-first Century*, and the work of the Architectural League of New York and their 1992 publication *New Schools for New York: Plans and Precedents for Small Schools*.

Fourth, communalities between these literatures were examined by asking the questions: Were findings from the empirical literature reflected in any of the recent design trends? Is there empirical support for some of the educational reform ideas? It was found that, on whole, none of the architectural publications made any reference to scientific findings and none of the empirical studies cited particular buildings. Few of the architectural presentations referred to any type of assessment of facilities (with the exception of the British *Architect's Journal* and *Architectural Review*). However, some communalities were noted. For example, the findings on the limitations of open plan schools and the research reported from our own labs on "modified open plan schools" is directly related to the architectural trend toward suites of classrooms and the pod school.

Fifth, following this process, a set of 27 design patterns were inductively created from the analysis of communalities in the literatures. The following Chapters 5, 6, and 7 expand on these steps: Chapter 5 shows implications especially from the educational reform literature, Chapter 6 the full set of 27 patterns, and Chapter 7 an example of using the patterns to create a prototypical design for a new type of educational facility.

¹⁵ A recent example was at the architectural jury presentation and exhibit of school architecture cosponsored by the American Institute of Architects at the American Association of School Administrators 1993 conference in Orlando. In answer to a question, the chair of the jury remarked that none of the approximately 100 submissions broke new conceptual or educational ground. None reported any connection to the educational research, environment-behavior, or educational reform literatures.

Patterns for Schools and School Design

We have developed a set of the most important patterns for schools and school design.¹⁶ Each of our *patterns* is a design principle that may shape the form of the future design of schools. They are organized into four clusters, or four levels of hierarchy:

1. Planning Principles
2. Building Organizing Principles
3. The Character of Individual Spaces
4. Critical Technical Details

To date we have generated 27 patterns,¹⁷ of which two will be presented in some detail in the current chapter (but see also the review of critical environment-behavior evidence in Chapter 2 above): And the Winning School is ... Smaller, and Well-Defined Activity Pockets.

Case Study: Two Patterns based on Environment-Behavior Research

In this chapter, as a case study of the above process and of the value of interpreting and translating EB research literature, we will present two of the patterns in some detail as examples. These patterns are based on the empirical EB evidence reviewed in Chapter 2, one directly linked to academic achievement and the second linked to expected achievements through mediating prosocial behaviors.¹⁸

And the Winning School is ... Smaller

One of the first issues school Boards, administrators, educational facility planners, and other educational leaders must address in educational facility planning is the optimal overall size of a school.

¹⁶ While some of our patterns not discussed in this paper, like Building Core or Great Spaces, have been influenced by Brubaker's "These 21 trends will shape the future of school design" (1988), our set of patterns is based on inductive translations of existing empirical research and thus is not the same as Brubaker's set of trends.

¹⁷ This list is by no means exhaustive. We hope that as a result of the publication of this brief paper we can generate some discussion that will help us to refine the list, combine or delete redundant patterns, and develop needed new ones.

¹⁸ The next chapter, "Design patterns for American Schools: Responding to the reform movement," examines seven patterns based largely on the reform movement (e.g., Fiske, 1991).

The Public Education Association, as mentioned earlier, has argued for downsizing schools to 500 to 600 pupils per school. The argument goes that smaller is better, that smaller schools will lead to a more humane educational system.

And, as reviewed above, the environment-behavior evidence is that in comparison to large schools (over 1000 students), small (400-500 students) and medium-sized schools (900-1000 students) have better educational records. More students are involved in governing decisions. All other things held equal, there is less crime. There is more sense of responsibility. Discipline is higher. Less misconduct is found after schools subdivide 3,000 students into a number of smaller schools. Large schools undermine character development and socialization to adulthood by not providing a full range of participatory activities. Conversely, students in smaller and medium-sized schools take more part in extra-curricular activities, there is more overlapping of roles, they are more satisfied with the participation, and overall they have more positive self concepts.

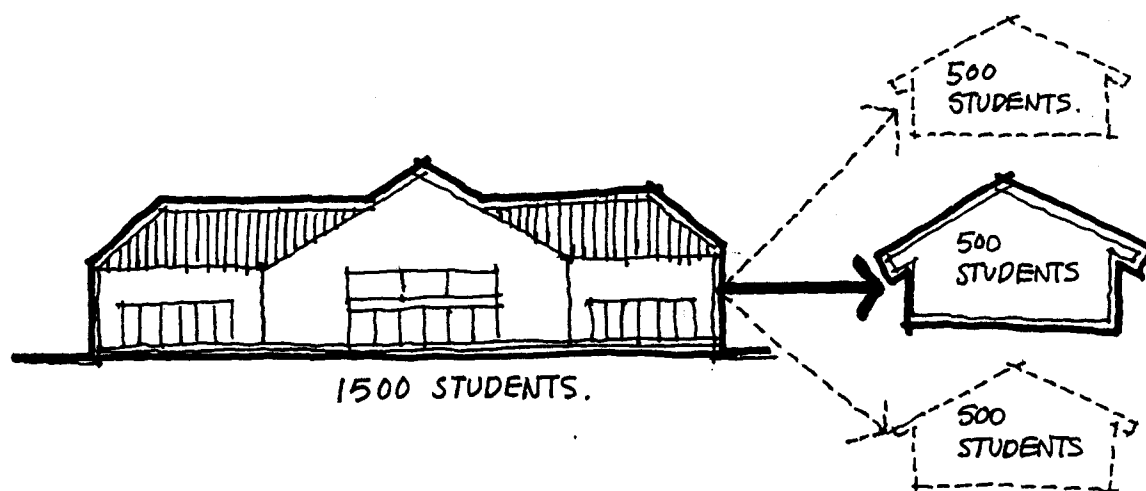


Figure 4.1. And the winning school is ... smaller.

As Paul Goldberger's review of the design competition on "New Schools for New York" concluded (see also Genevro, 1990; Rieselbach, 1990), "Educators have begun to suggest that the real sin in contemporary school design is size ... and the winning school is ... smaller" (Goldberger, *New York Times*, May 27, 1990).

The pattern is creating schools of approximately 500 students, or subdividing larger schools (1,500 or more) into a campus-plan or clustered-plan of semi-autonomous modules of 500 students each.

Well-Defined Activity Pockets

Concordant with the notion of smaller, more personal schools is the architectural definition of areas within the schools and within "classroom."

Research conducted at our Center has discovered that architecturally well-defined behavior settings (in contrast with partially and poorly articulated settings) contribute to significantly greater degree of engagement with learning activities, more teacher involvement with children, less teacher interruptions, and more exploratory behavior, social interaction, and cooperative behaviors among the children (Moore, 1986). Other research on classroom design has found that smaller clusters lead to increased use of learning materials (Weinstein, 1982), to increased substantive, content questions (Evans & Lovell, 1979), less non-task-oriented movement, less loud conversations, longer attention spans, and overall greater satisfaction.

As reviewed earlier, sound absorbing partitions used to create Well-defined Activity Pockets redirect traffic, demarcate class boundaries, and create small areas for privacy, all of which presumably will lead to increased achievement measured by standardized educational tests.

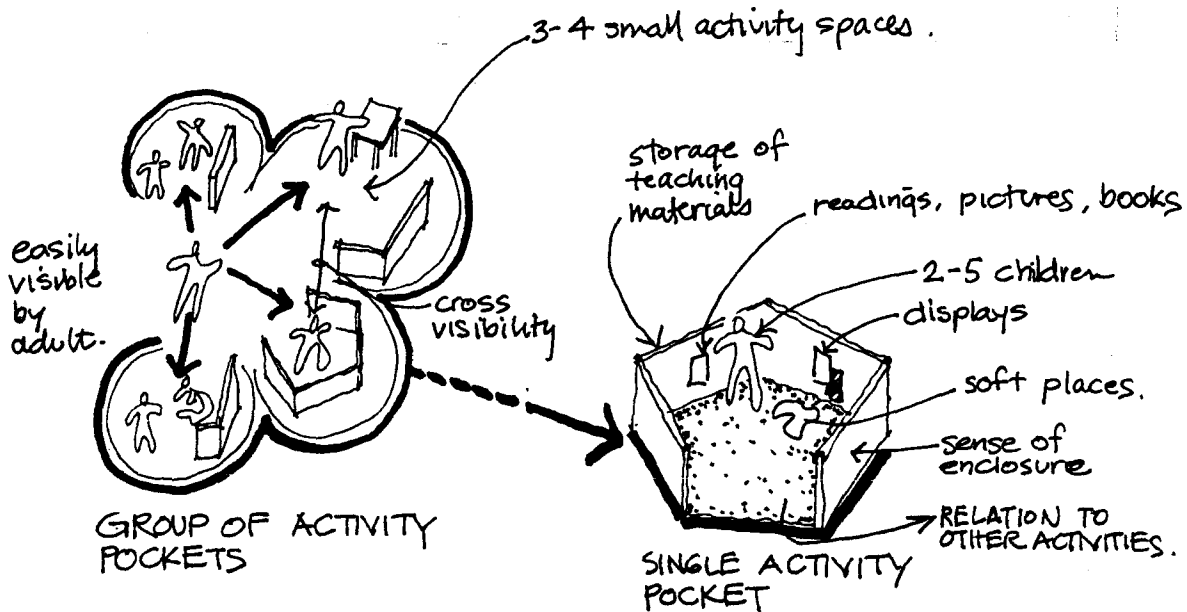


Figure 4.2. Well-defined activity pockets.

Well-defined Activity Pockets is a clear environment-behavior issue with considerably supporting research that many designers have picked up on with lecture pits, lofts, well-articulated activity nooks, and various other measures to isolate noise, dirt, and congestion from the primary learning centers. We have even recently found an early and influential educational facilities design book, *Planning Flexible Learning Places*, published in 1977 (Leggett, Brubaker, Cohodes, & Shapiro, 1977) which, though not based on empirical research, advocated giving students architecturally well-defined "turf" for small-group learning activities.

In both of these patterns, as in the other ideas emerging from the empirical EB research literature and from the educational reform movement, school designers and planners *who are familiar with the research literature and sensitive to the needs of children can* give form to emerging research and educational concepts.