

**Improving the Physical and Social Environment of School:  
The Effects of Building Renovation on Teaching and Learning**

1. Objectives or purposes

This paper explores the interplay between quality facilities, school climate, and student achievement, charting the effects of facility improvements on student and teacher attitudes, behaviors, and performance within schools undergoing renovations in a large Southern California urban school district. The research applies a *Leadership-School Building Design* model (Authors, in press) to explore how school climate (academic press, teacher professionalism, and community engagement) interacts with six characteristics of facility quality, mediating their combined influence on student learning and achievement.

2. Perspective(s) or theoretical framework

A growing body of research connects the quality of school facilities to both student outcomes including achievement, behavior, and attitude as well as to teacher attitude and behavior. Reviewed elsewhere, the scholarship blends divergent strands of inquiry, including sociology, psychology, architecture, along with education (Author, 2008; Earthman, 2004; Evans, 2006; Lackney, 2005; Schneider, 2002; Tanner & Lackney, 2006). Less is known about the mechanisms of these relationships. The present study is the third phase of ongoing investigation into the complicated interplay between the physical and social environments of school, and how these dynamics influence student outcomes.

The proposition examined in the first phase of study was that at least part of the explanation for the link between school building quality and student outcomes is the mediating influence of school climate (Author, 2008). It was hypothesized that the quality of school facilities would be related to four factors of school climate, including academic press, community engagement, teacher professionalism, and the collegial leadership of the principal (DiPaola and Tschannen-Moran, 2005; Hoy, Hannum, and Tschannen-Moran,

1998; Hoy and Sabo, 1998; Hoy, Tarter, and Kottkamp, 1991; Tarter, Sabo, and Hoy, 1995; Tschannen-Moran, Parish, and DiPaola, 2006). About one third of the faculty members present at regularly scheduled faculty meetings in 82 Virginia middle schools were selected at random to complete a survey concerning the quality of educational facilities and other school climate variables. Correlational analyses indicated that quality facilities were significantly, positively related to three school climate variables: academic press, teacher professionalism, and community engagement. Results confirmed the hypothesis that school climate plays a mediating role in the effects of the quality of school facilities on student achievement.

In order to further explore how a school building's physical properties influence teaching and learning, follow up studies were conducted in two high poverty schools within the upper quartile of facilities quality (Authors, in press). We were interested to learn how high quality facilities nurture a positive school climate and high levels of student achievement in schools that serve a primarily disadvantaged (socio-economically) student population. Researchers triangulated data from individual and focus group interviews, walkthrough interviews, and student-generated photographic documentation at each of the case study schools.

Findings of the research indicated that ongoing interactions between the design and reality of the built environment, and the occupants of that environment helped to define the learning climate of these schools. Reciprocally, the climate helped to shape the social interactions that took place, fostering environmental understanding, competence and control and supporting academic learning. As building occupants shared in the creation of the environment, they revealed an individual and collective sense of themselves. In turn, the environment gave back, reinforcing self-identity and a deeper sense of belonging (Proshansky and Fabian, 1987; Proshansky, Fabian, & Kaminoff, 1995). From the data, several broad themes related to building quality emerged as central to this interaction between the built environment and building occupants; these included movement, aesthetics, play of light, and so on. We advance a *school leadership-building design model* as a means to describe this dynamic interaction.

In the present study, we apply this model to explore the interplay between quality facilities, school climate, and student achievement, charting the effects of facility

improvements on student and teacher attitudes, behaviors, and performance within schools undergoing renovations in a large urban school district. Here we apply mixed research methods using a triangulation convergence model (Creswell & Plano Clark, 2007).

Applying methodologies utilized within the first two phases of the research, researchers collect and analyzes quantitative and qualitative data separately with the different results converged by comparing and contrasting during the interpretation to enrich the descriptions of the case study schools and chart changes in their physical and social environments, as well as changes in student performance, over time (Morse, 1991).

### 1. Research Questions for Proposed Study

Much of the past research on the relationship between the physical attributes of educational environments and student learning, behavior, attitudes and performance draws comparisons across different school settings. The current study further explores the mechanisms of such relationships, charting the interrelationship between school building quality, school climate and achievement overtime in the *same* schools within one school district.

*Primary Research Question:*

To what degree, and in what manner, are specific improvements in building quality associated with a positive school climate, bolstering occupants' capacity to teach and learn?

*Secondary questions include:*

In what ways are the inadequacies of existing facilities associated with school climate and how do occupants compensate for the limitations?

To what degree, and in what manner, are specific improvements in building quality connected to school climate, encouraging or discouraging a clear focus on academics, engendering in teachers a sense of enthusiasm for teaching, and fostering a constructive relationship between school occupants and the community?

In what ways do occupants leverage the specific design features of renovated facilities on behalf of teaching and learning?

To what degree and in what manner are specific improvements to building quality associated with the occupants' individual and collective identities as learners?

#### 4. Methods, techniques, or modes of inquiry

The schools are being studied over a two-year period with data being collected before and after renovations. In order to chart changes in occupants' perceptions of the physical environment and the social environment of the schools under study, researchers administer the measure of school facility quality, the measure of resource support, and the subscales of the School Climate Index, administered in Phase One, before and after renovations. Data are aggregated to the building level for analysis, then standardized against the sample of 82 Virginia schools from the original study. Student performance results provide further contextual data on the case study schools, as well as opportunities for comparisons with the norming sample. Data sources or evidence

Data were gathered from surveys completed by teachers in the nine schools undergoing renovation within the district. Researchers administer the surveys during a faculty meeting at each school. A member of the research team explained the general purpose of the study, assure the confidentiality of all responses, and asked teachers to complete the questionnaires. Because the unit of analysis is the school, the teachers in each school respond to the measures concerning the quality of school facilities and the school climate variables with results aggregated to the school level.

Bivariate correlational analysis on the measure of resource support and the subscales of the School Climate Index are used to explore the relationships between the quality of school facilities, resource support, school climate, student socioeconomic status, and student achievement. Finally, multiple regression is used to test school climate as a mediating variable between the quality of school facilities and student achievement.

Researchers triangulate qualitative data by way of individual and focus group interviews, walkthrough interviews, and student-generated photographic documentation

conducted before and after renovations. Participants include building principals, teachers, students, parents, and the school custodians in three of the nine schools. The interviewer asks semi-structured questions (Fontana & Frey, 2000) about various features of the school building and how these characteristics and conditions support and/or impede communication, interaction, and learning among students, teachers, and parents while still encouraging a certain degree of open-ended response from participants. Interview protocols are similar across participant groups, acknowledging the need for tailoring of questions in response to the roles, responsibilities, and experiences of various occupants, at the same time allowing for comparisons of responses across these groups.

During photo interviews, we give a camera (either digital or traditional film) to students with the assignment to document through the lens the ways that their school building influences their learning. The photograph thus becomes a bridge between student and researcher (Collier & Collier, 1986). Following the photo interview model (Capello, 2005), the researchers invite the student photographer to order the images from most significant architecturally to least significant. Using an interview protocol (Patton, 1990), researchers ask students to describe why they chose to make the photographs they did and describe why the subjects of the photographs do or do not contribute to the learning environment at the school.

Walking interviews help researchers experience the school facility in the company of representative occupants to learn how they respond to the physical features of the school (Nelson, 2001). A parent, teacher and administrator each take the researchers on a tour of the building and share their perceptions and feelings as well as how they make meaning in response to the arrangement of spaces. Qualitative data are organized, classified and coded using manual techniques as well as HyperRESEARCH, software designed to handle unstructured qualitative data (ResearchWare, Inc., 2007). Data analysis occurs continuously throughout data collection as the researcher attempts to identify emerging themes, as well as tease out anomalies and contradictions (Holsti, 1969; Merriam, 1988).

## 5. Findings and/or conclusions/point of view

Researchers report preliminary findings from research in progress. Early results indicate that ongoing interactions between the design and reality of the built environment and the occupants of that environment helped to define the learning climate of these schools, for better or worse. Prior to renovation, where teachers perceived their facilities to be inadequate, there tended not to be a clear focus on academics, and the learning environment was not perceived as orderly and serious. In these existing facilities, occupants were frustrated in their attempts to engage the community. Teachers communicated limited enthusiasm for their jobs. Principals recalled circumstances that moved them to confront existing problems and/or acknowledge missed opportunities. With an eye toward the new opportunities provided by renovated spaces, teachers, leaders, parents, custodians actively challenged existing spatial routines through re-conceptions of classroom arrangements, enhancements to entryways, changes in paths of movement through the building, and so forth. Where various aspects of the built environment introduced constraints on learning, occupants and important stakeholders made significant choices about the spaces within the building, the results of which contributed to improved learning. In all three case study schools, educational leaders worked flexibly with other occupants, discovering how the design features of the building could be leveraged to improve both climate and achievement.

## 6. Educational or scientific importance of the study

Study results should help school-building occupants better understand the ways in which the physical environment of their school enhances and/or impedes teaching and learning. Administrators and teachers may better utilize classroom and specialized areas within the school to advance their educational goals. Teachers and administrators should learn how students perceive the various features and places--which are of particular importance to students, which they feel help them learn, and which they particularly value. Administrators might better utilize the built environment to welcome and involve parents in the life of the school as a result of this study.

We are beginning to understand how and when a school's physical structure reinforces the established goals of teaching and learning and why certain spaces work while others do not. Evidence that school climate plays a mediating role in the effect that school building quality has on student achievement suggests that certain building improvements and design features leverage stronger results than others. At the very least, design features that serve to reinforce and enhance the social environment of school should not be underestimated in their importance. Further, as school designers balance considerations of durability with flexibility, the voices of these occupants argue for the inclusion of design features that allow occupants some measure of control over comfort and use factors.

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