

The Walls Speak: The Interplay of Quality Facilities, School Climate, and Student Achievement

Statement of Purpose and Rationale:

The condition of our nation's school buildings has recently entered into public discourse through Bill Moyer's (1995) television special, "Children in America's Schools" and Jonathon Kozol's (1991) expose on the conditions under which many low-income students are educated, *Savage Inequalities*. But does the quality and condition of school buildings really matter? Does it matter if a community like Ramona, California chooses not to invest in school buildings at all, instead choosing to run an entire elementary school in portable "learning cottages"? Or is there something about the space that a school occupies that matters?

There is a growing body of literature that provides evidence to a link between school building adequacy and student achievement. One unexamined link between school facilities and student achievement may be school climate. School climate may be a mediating variable, explaining at least in part, the deleterious impact that poor school facilities has on learning. It may be that dilapidated, crowded, or uncomfortable school buildings lead to low morale and to reduced effort on the part of teachers and students alike, to reduced community engagement with a school and even to less positive forms of school leadership. It may be that it is these dynamics that are responsible for the drop in achievement when school facilities are inadequate.

Theoretical Framework

Twenty-one percent of U.S. schools are more than fifty years old and another fifty percent are at least thirty years old. These schools now require a total of \$127 billion dollars in new construction and retro-fitting (Office of Education Research and Improvement, 2000). A National Education Association (NEA) study places the need at more than double those estimates, bringing the cost of modernizing America's schools to \$268 billion. Add to this \$52 billion for technology needs and the total surges to \$322 billion (NEA, 2000). Industry experts estimated that in the year 2001 more than \$26.8 billion were spent on elementary and secondary school construction and similarly that \$24.3 billion were spent in 2002 (Kennedy & Agron, 2004). The needs of school building construction and repair present us with a tremendous challenge and, at the same time, an extraordinary opportunity. With the investment of such large expenditures of taxpayer money comes the responsibility to be thoughtful as we approach the issue of school design.

Accompanying the recent increase in school design and construction expenditures has come an explosion in related research. Laying the foundation, McGuffey (1982) identified a number of studies that examined the possibility of a relationship between building condition and student performance on standardized tests. The findings, synthesized across a number of studies, linked student achievement with building quality, newer buildings, improved lighting, thermal comfort and indoor air quality, as well as specific building features such as science laboratories and libraries. More recent research has continued to add to the evidence of a direct link between the quality of a school's physical environment and student achievement.

In a study of the Washington, D.C. public schools, a committee of experts including engineers, architects, and maintenance staff rated buildings poor, fair, or excellent according to their overall physical condition. Raters evaluated roofs, ceilings and walls, heating and electrical systems, and bathroom facilities. The findings indicated that the physical state of a school was a predictor of student achievement. Data suggested that as schools move from poor to fair, average achievement scores can be expected to increase by 5.46 points, while improvement from poor to excellent resulted in a 10.9 point increase (Berner, 1993). Likewise, a relationship was found between the degree to which schools in the Los Angeles Unified School District complied with health and safety regulations and student academic performance in these schools, as measured by California's API indicator of student performance (Buckley, Schneider, & Shang, 2004).

In another study of school building design and student learning, Cash (1993) found that comfort factors appeared to have more of an effect on student achievement than did structural factors. High achievement was associated with schools that were air conditioned, enjoyed less noisy external environments, had less graffiti, and where classroom furniture and student lockers were in good repair.

More recent reviews have consistently found relationships between building quality and academic outcomes (Earthman, 2004; Earthman & Lemasters, 1996, 1998; Higgins, Hall, Wall, Woolner, & McCaughey, 2005; Schneider, 2002). These studies have also found that that design criteria and building conditions related to human comfort, indoor air quality, lighting, acoustical control, and secondary science laboratories have demonstrable impact on student achievement.

Earthman (2004) rates temperature, heating and air quality the most important individual elements affecting for student achievement. Lighting ranked next in order of criteria having demonstrable effects on student learning outcomes, with daylight offering the most positive effect (Earthman, 2004; Heschong Mahone Group, 2003), potentially due to its biological effects on the human body (Wurtman, 1975). Tanner (2000) underscores important recurring patterns of school design. Among the four features of his school design assessment scale which correlate with student achievement, are 'pathways' encouraging ease of movement and 'positive outdoor spaces' allowing learning to extend beyond the classroom walls.

Overcrowding has been found to have a deleterious effect on student learning (Earthman, 2004). As well, chronic noise exposure hinders cognitive functioning and impairs pre-reading and reading skills (Haines et al, 2001; Evans & Maxwell, 1997, Maxwell & Evans, 2000). The quality of school buildings has also been related to student behavior, including vandalism, absenteeism, suspensions, disciplinary incidents, violence, and smoking (Schneider, 2002). Thus, reviews of research on various aspects of the physical environment tend to conclude that adequate student capacity and appropriate acoustical conditions are important factors in a school environment (Fisher, 2001; Schneider, 2002; Earthman, 2004).

Students are not the only ones affected by poor quality buildings. Teacher attitudes and behaviors have also been found to be related to the quality of school facilities. Teacher retention/attrition decisions were significantly related to the quality of school facilities, even when controlling for a host of factors (Buckley, Schneider, & Shang, 2004). Factors that most directly affected the quality of teacher work life also included indoor air quality (IAQ), thermal

controls, noise level and acoustics, adequate classroom lighting, and the amount of natural daylight. Teachers who perceived a detrimental effect on their health due to building conditions, or who were stressed by high noise levels, poor acoustics, and lack of thermal controls were more likely to seek employment elsewhere.

The proposition examined in this 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. It was hypothesized that the quality of school facilities would be related to four factors of school climate: academic press, community engagement, teacher professionalism, and the collegial leadership of the principal.

Methods of Inquiry

Participants from 82 middle schools in Virginia completed surveys at a regularly scheduled faculty meeting. About one third of the faculty members present were selected at random to complete a survey concerning the quality of educational facilities and other school climate variables. Survey measures included the following:

School Climate Index. The School Climate Index (SCI) is a new measure of school climate (Tschannen-Moran, Parish, & DiPaola, in press), adapted from the work of Hoy and his colleagues. The scale is comprised of four subscales. The first three subscales, academic press, teacher professionalism, and collegial leadership, grew out of a combination of the *Organizational Health Index* and the *Organizational Climate Descriptive Questionnaire* (Hoy, Hannum, & Tschannen-Moran, 1998). The final subscale, community engagement, was developed to tap schools' relationships with their communities. Each of the items requires respondents to assess how frequently the statement is true of his or her school, along a five-point scale. The resource support and facilities scales made use of the same response scale. Sample items include:

- Students respect others who get good grades.
- Community members are responsive to requests for participation.
- Teachers are committed to helping students.
- The principal is friendly and approachable.

Quality of Facilities. This scale asks teachers their perceptions about the degree to which their facilities are well maintained and attractive. Seven items comprised this scale ($\alpha = .92$). Sample items include:

- This building is pleasing in appearance.
- The facilities here are lacking in regular maintenance.(reverse-coded)

Resource Support. This scale requires teachers to assess the degree to which they have the materials and supplies they need to accomplish their teaching duties. Three items comprise this scale ($\alpha = .80$). Sample items include:

- Teachers are provided with adequate materials for their classrooms.
- Extra materials are available if requested.

Student Achievement. Data for student achievement were drawn from three eighth-grade Virginia Standards of Learning (SOL) tests: English (Reading, Research, and Literature), Math, and Writing.

Student SES. The proportion of students receiving free and reduced price lunches, were gathered from the Virginia Department of Education website.

Findings

Preliminary findings indicate that quality facilities were significantly positively related to all of the school climate variables: collegial leadership, teacher professionalism, academic press, and community engagement. The quality of facilities was surprisingly uncorrelated to student SES, although resource support was related to SES. Resource support and quality facilities were related, indicating that where resources were adequate, facilities also tended to be of higher quality. As in earlier research, both facilities quality and climate were found to be related to student achievement. Future analyses will examine school climate as a mediating variable between facilities quality and student achievement.

Conclusions

Despite the recent increases in school construction, one in four schools continue to “mak[e] do with buildings in poor condition” (Mead, 2005, p.1). In fact, the American Society for Civil Engineers’ 2005 report card assigned the nation’s educational infrastructure a disappointing D for the overall condition of America’s school buildings (American Society of Civil Engineers, 2005). Even as evidence mounts regarding the detrimental effects these poor conditions have on students and teachers, school district leaders struggle to convince federal policy makers and local taxpayers of the need to invest resources in replacing and/or renovating inadequate school facilities. It appears many remain unconvinced about the seriousness of the problem.

Researchers concur that it is difficult to reach firm conclusions about the impact of built learning environments on teacher performance and student outcomes, both “because of the multi-faceted nature of these environments and the subsequent diverse and disconnected nature of the research literature” (Higgins, Hall, Wall, Woolner, & McCaughey, 2005, p. 6). Do we know how and when a school’s physical structure reinforces the established goals of teaching and learning? Do we understand why certain spaces work and others do not? Although we have begun to focus on discrete, physical, behavioral, and attitudinal variables, establishing a growing body of evidence underscoring the linkages between quality facilities and student achievement, it is important to acknowledge that such social influences are generally reciprocal and interactive, and thus difficult to quantify (Lackney, 1996). Any empirical research must be sympathetic to the complex dynamics of how these social experiences influence behavior.

As both public and policy communities demand proof prior to making further investments, researchers seek to bolster the case for decent schools with quantifiable correlations between bricks and mortar and student learning. In their search for hard evidence, researchers must not skirt the complicated intricacies of how a school building’s physical properties influence teaching and learning. Oversimplifications of the relationship may only heighten skepticism. It behooves us to explore measures of perception and orientation, of preference and appreciation, as mediating variables (Uline, 2000). Considering the degree to which school climate mediates this complicated interplay of factors, may help to tell a compelling story about how human comfort, pleasing appearance, adequacy of space, functional furniture and equipment, a clean and orderly environment, and regular maintenance effects occupants’ sense of well being and thus their ability to teach and learn.

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