



## **Impact of Facilities on Student Performance**

There is significant research to demonstrate that the quality of the physical environment affects student achievement, as well as staff attitudes and behavior (Cash, 1993; Crook, 2006; Hickman, 2002; Hines, 1996; Lee, 2006).

Appropriate lighting, acoustics, comfortable temperature and humidity controls, cleanliness, sometimes color, air quality, and so on, affect teaching and learning (Earthman, 2002, School Facility Conditions and student academic achievement; Schneider, 2002, Do School Facilities Affect Academic outcomes, NCEF). It follows that ubiquitous technology, modern science laboratories, special education units, preschool classrooms, kindergarten, vocational classrooms, music and art classrooms, family resource centers, and other specialty classrooms, also support curriculum programs and improve the quality of teaching and learning. The following conclusions are a few examples from archived research from the United States Department of Education:

- Students learning in better building conditions earn 5-17 percent higher test scores than students in substandard buildings.<sup>1</sup>
- Students' standardized achievement scores rose 10.9 percent in schools which improved building conditions from poor to excellent.<sup>2</sup>
- Students experience a significant reduction in analytical ability, reading speed, and reading comprehension when classroom temperatures exceed 73.4 degrees.<sup>3</sup> In nine additional studies, the importance of a controlled thermal environment was stressed as necessary for satisfactory student performance.<sup>4</sup>
- Students in classrooms with the most exposure to daylight progressed 20 percent faster on math tests and 26 percent faster on reading tests than those in classrooms with the least exposure to daylight.<sup>5</sup>
- As the age of school buildings increases, the achievement scores of students tend to decrease.<sup>6</sup> Facilities conditions may have a stronger impact on a student's academic performance than the combined influences of family background, socioeconomic status, school attendance, and behavior.<sup>7</sup>
- When class sizes are reduced below 20 students, related increases in student achievement move the average student from the 50th percentile up to somewhere above the 60th percentile, with even greater achievement results for disadvantaged and minority students.<sup>8</sup>
- Schools with better building conditions experience up to 14 percent lower suspension rates than those with unsatisfactory conditions.<sup>9</sup>

- The quality of the learning environment has a 66 percent greater impact on teacher retention than salary.<sup>10</sup>

Perhaps what is more subtle, is the proposition that the education facility is a model for delivering educational services. In the Kentucky Picus Study on Education Adequacy (2003), exemplary education models were confirmed to ensure adequacy and (if thoughtfully and uniformly implemented), equity. The proposed exemplary facility models included education components as well as optimum building and class sizes. Picus recommended the following for Kentucky schools:

- School Size:
  - “Research on school size is clearer than research on class size; the optimum size for elementary schools is 300-600 and the optimum size for secondary schools is 600-900 (Andrews, Duncombe & Yinger, 2002; Lee & Smith, 1997; Raywid, 1997/1998). Thus, no elementary school unit should be larger than 500 to 600 students and no secondary school unit should be larger than 900 to 1,000 students. (High schools of this size should be divided into two “schools-within-a-school.”) Given the current stock of large school buildings, this means creating several independent “schools” within these larger buildings, each with a separate student body, separate principal, and separate entrance, if possible (see also Murphy, Beck, Crawford, Hodges & McGaughy, 2001). For secondary schools, research also finds that curriculum offerings should emphasize a large core of academic classes for all students (Bryk, Lee & Holland, 1993; Lee, Croninger & Smith, 1997; Newman, 1997). It also means no construction of large school buildings in the future. All subsequent cost figures are for a school unit of 500 students, as nearly all comprehensive school designs recommend that large schools be divided into separate education units of about 500 students.”
- Class Size:
  - “Research on class size shows that small classes of 15 (not 18, not 20, and not a class of 30 with an instructional aide or two teachers) in kindergarten through grade 3 have significant, positive impacts on student achievement in mathematics and reading (Gerber, Finn, Achilles & Zaharias, 2001; Grismer, 1999; Mishel & Rothstein, 2002). The impact is larger for students from low income and minority backgrounds. Thus, class sizes should be 15 in grades kindergarten through grade 3. Class sizes in other grades should be no larger than an average of 25, which is about the national average and the size on which most comprehensive school reform models are based.”
- KERA and Facility Planning and Construction:
  - In accordance with the Kentucky Education Reform Act (KERA) and the Picus recommendations, the Kentucky Board of Education (1992) adopted administrative regulations on public school facility planning including school and class size. Further, they enacted a community based planning effort aligned with

many philosophical provisions of education reform, including quality models, diverse community involvement and a holistic approach to planning. Plans incorporated relative condition, educational suitability of existing buildings, cost of delivery of services, transportation, curriculum and educational programs. All Kentucky public school facilities were measured against exemplary models supported by the Picus research, and school facility needs were assessed accordingly. Public School Design and construction, or the remediation of Kentucky's School Facilities, has been intentionally focused on these models since 1992 for equity and adequacy.

- School Size and Student Outcomes:
  - In November of 2005 the Kentucky Legislative Research Commission (LRC) published, "School Size and Student Outcomes in Public Schools" where the Picus models were tested against student assessment data. With a few minor qualifications, it was determined that statistically, students that attended schools of sizes recommended by Picus and the Kentucky School Facilities Planning Manual (702 KAR 4:180) scored higher than in schools that did not meet enrollment best practice models. Since 1994, the number of Kentucky schools in service that did not meet best practice enrollment have been reduced by 121 schools (in a 1200 school inventory) from 272 to 151. This has been accomplished utilizing best practice models with the additional demographic challenge of declining student population in many districts, and growth in about 2% of districts. Facility planning studies indicate that these efforts have (overall) lowered the cost of delivery of services by about \$400,000 per school (of the 121 no longer in service) at an annual recurring savings of about \$48,000,000 per year (statewide). In theory, this savings has been accomplished while creating exemplary educational facility models that should cause enhanced student performance. All decisions were made within parameters of regulation and best practices by local planning committees and local boards of education.

In addition, 60% of all Kentucky's schools have been renovated or replaced since 1993, utilizing the same regulations and measures (6,300 projects at \$8.0 billion.) The outcome of the improved infrastructure should be of some consequence in Kentucky's improved student performance.

#### 2010 Legislation:

In 2010, the General Assembly enacted KRS 157.455 which included the following provision:

"(2) The General Assembly hereby finds that schools that are constructed or renovated using efficient school design are proven effective vehicles for accomplishing some or all of the following beneficial public purposes:" (including) "Improved student attendance and performance by:

- Using the building as a teaching tool
- Using the local environment as a context for curriculum integration
- Providing rigorous, highly relevant, and applied learning

- Improving productivity by making buildings healthier for occupants, especially through the increased use of natural light.”

The General Assembly also amended KRS 157.420 to include the following: “(9) Beginning in fiscal year 2011-2012, the Kentucky Department of Education shall standardize the process for evaluating the overall quality and condition of all school buildings across the state. The evaluation process shall: (d) Use of a third-party evaluator that utilizes an established software-based system to perform the first, base-line evaluation.” The school facility actions in the 2010 session of the General Assembly recognize the connection between the built environment and student performance, requiring school districts to be intentional in school construction and renovation. The third-party facility data system will benchmark the quality of educational facilities in Kentucky to help sustain information regarding their equity and adequacy, as prescribed by the Kentucky Education Reform Act of 1990.

Summary:

After 21 years of education reform, many Kentucky districts have adequate revenue and facilities aligned as exemplary educational models. Students are benefitting, through many environmental enhancements conducive to teaching and learning. Current data indicates, however, that there are at least ten percent of public schools in Kentucky that do not meet current standards. It is a challenge to our state mission that these facilities receive proper remediation. In Kentucky, we have learned, in practice, (though it is not properly documented) the value of the physical environment to the delivery of educational services, student opportunity, and learning. This has manifested itself in the support of the school building program by local school districts and the General Assembly since 1990. In 2011, as Kentucky moves to capture its facility inventory data by way of the new provisions of KRS 157.420, we will have the opportunity to conduct valuable research (on an unprecedented scale) to verify the real impact of our facility program on Kentucky student outcomes. We can develop strategies to better prioritize needs and allocate resources. We have learned that exemplary school models not only house and support curriculum and programs but also impact student learning and the cost of delivery of services.