EVIDENCE-BASED DESIGN IN SCHOOLS:
CLASSROOM DESIGN AND ACADEMIC ACHIEVEMENT

By Don Tomasi, AIA LEED AP
Is it possible to design a classroom that measurably improves academic performance? With the emergence of evidence-based design this is indeed possible. Evidence-based design is the process of basing decisions about the built environment on credible research to achieve the best possible outcomes. Evidence-based design first emerged in the design of health care facilities. The result of measuring the influence of various design factors on patient outcomes has considerably altered the design of hospitals and other medical facilities over the past several years.

Evidence-based design is increasingly focusing on educational facilities and is an emerging influence on the design of schools. Particularly intriguing are studies that correlate certain aspects of learning environments with academic performance. Evidence-based design has also investigated other measurable outcomes including improved student attendance, reduced disciplinary problems, and better faculty retention.

Focusing on classroom interiors, several studies over the past several years establish links between specific design characteristics and academic performance. Importantly, each of these design characteristics can be readily implemented in both new and modernized schools.

**NATURAL LIGHTING**

The first and perhaps best-known evidence-based research into K12 facilities occurred in 1999. In a study of over 21,000 students, Heschong Mahone Group found a statistical correlation between the amount of daylight in elementary school classrooms and the performance of students on standardized math and reading tests. The study included the finding that classrooms with the most daylight (windows and/or skylights) progressed 15% faster in math and 23% faster in reading compared to students in classrooms with the least daylight, and that these results did not vary by grade.

It seems remarkable that such a simple design consideration can have such a profound impact on learning. Designing new classrooms with ample natural lighting is relatively straightforward, and it is usually possible to improve natural lighting in existing classrooms as well. When natural light is sufficient, energy costs are reduced as light fixtures are switched off. And because light fixtures generate much of the heat in classrooms, air conditioning costs are significantly reduced as well.

**ACOUSTICS**

There is a growing body of research linking noise from external sources and reverberation in the classroom to reading and spelling ability, behavior, attention, concentration, and academic achievement in children. As an example, one study found that students in classrooms having carpet had higher test scores in mathematics, language, and other subjects than students in rooms with hard surfaced floor coverings. Carpet modifies reverberation time, but there are many ways to control classroom acoustics. As a result it is relatively easy to design and modernize classrooms to optimize acoustics in order to enhance the learning environment.
FURNITURE DESIGN

A 2007 study compared adjustable school furniture with traditional fixed furniture. It found that students using adjustable furniture received higher grades in certain subjects than those in the control group with traditional furniture. Adjustable desks and chairs encouraged better sitting postures, and lessened the effects of several posture-related problems. Students with adjustable furniture were more satisfied with their desks and chairs, and reported fewer headaches and less pain in the neck-shoulder area, which was attributed to improved sitting postures. This study is corroborated by several others that did not attempt to correlate findings with academic performance, but found multiple health issues resulting from poor classroom furniture ergonomics.

Today there are numerous interesting school furniture options including adjustable desks and chairs as well as ergonomically designed fixed furniture. Classroom furniture has received relatively little attention, but that may be about to change.

INDOOR AIR QUALITY

Greener construction materials and better HVAC (heating, ventilation and air conditioning) systems can improve the quality of indoor air by minimizing carbon dioxide, germs, toxins and other airborne contaminants. Poor indoor air quality has been associated with increased student absenteeism. The American Lung Association found that American children miss more than 10 million school days each year because of asthma exacerbated by poor air quality. The bottom line is that poor indoor air quality makes both teachers and students sick. Taking steps to improve the quality of indoor air means less teacher absences and increased student attendance, both of which have a direct financial benefit to school districts.

Displacement ventilation, the subject of a previous white paper by this author is perhaps the most interesting, effective and cost-effective solution to both improved indoor air quality and reduced energy consumption. But even a traditional HVAC system that is designed with sufficient air circulation distribution can be effective.

Architects, interior designers, facilities planners and others traditionally rely on past experience, anecdotal evidence and preference in the design of schools. Imagine if we could instead rely on a robust body of measurable evidence that would allow classrooms, playgrounds and other school environments to be designed to facilitate and improve learning. As evidence-based design becomes more available we will increasingly be able to make informed decisions, allowing schools to be designed that promote learning, improve student attendance, reduce disciplinary problems, and increase faculty retention.

TLCD Architecture strives to incorporate current research into its school projects. Our in-house Interior Design team works closely with our architects to design classrooms and select furniture that can improve the learning environment. Our pioneering efforts with displacement ventilation as a means of improving indoor air quality while reducing energy consumption is but one example of our commitment to incorporate evidence-based design into our practice.
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