Green Building Policy and School Performance

S. Kelting and M. Montoya

The movement to construct high performance "green" buildings has had unprecedented market growth and continues to become a mainstream practice for constructing schools in the United States. This paper will consider how the results of government requirements for higher performance school buildings may affect the health and performance of students. The research focuses on educational leaders' perceptions of how they would prioritize green building strategies based on recent governmental policy that requires building green schools. There is clear and compelling evidence that schools currently built to specific green standards of indoor environmental quality, specifically lighting, result in healthier and more productive students. Interview results concluded that educational leaders' perceived energy savings strategies to be more important than indoor environmental quality in the design and construction of new schools.

Introduction

The United States Green Building Council (USGBC), a widely recognized green building certification organization, categorizes the three primary benefits of green building as: economic, environmental and health.

"The economic benefits are: reduced operating costs, enhanced asset value and profits, improved employee productivity and satisfaction, and optimized life-cycle economic performance. The environmental benefits are: protected ecosystems, improved air and water quality, reduced solid waste, and to conserve natural resources. Health benefits are: Improved air, thermal, and acoustic environments, enhanced occupant comfort and health, and minimized strain on local infrastructure" (USGBC, 2009).

The majority of both the building industry and environmental groups endorse green building policy. Green schools have reduced operating costs for school owners and administrators and have improved the health and performance of students. The ease of state adoption of green building requirements defies the conventional idea of

environmental policymaking being difficult due to industry opposing environmental interests (Ingram and Mann, 1989). This has allowed legislative debates to take place out of the media's attention with enactment by overwhelming majorities. The 21st Century Green High-Performing Public Schools Facilities Act was passed Thursday, May 14, 2009 by the U .S. House of Representatives. The bill encourages energy efficiency and the use of renewable resources, but does not delineate a detailed plan for indoor environmental quality, nor does it use student performance as a justification. The bill authorizes more than $6.4 billion in grant funds to support school repair, renovations and modernization projects in school districts nationwide. Detailed in a small portion of the bill, school districts would be required to spend an increasing portion of funds received for projects consistent with identified green building systems, with the funds reaching 100% by 2015. This paper will utilize policy theory as a framework to examine whether the health and student performance benefits of green building in schools is of less importance than energy efficiency as perceived by educational leaders. Frameworks allowed us to analyze (or predict) the likely impact of the educational leaders perceptions. Additionally, this paper will review literature on lighting and its' affect on students and the policies that have been implemented, and address the potential limitations of the research and adopted policies.

Methodology

A literature review has revealed that there is limited research providing information regarding educational leaders' perceptions of green building and how they may impact the design and construction of new educational facilities. This may lead to educational leaders lacking understanding about the decisions made pertaining to the incorporation of green building strategies into the design and construction of new school facilities. We used exploratory qualitative research to describe the perceptions of educational leaders. Due to the rapid change of green building policy on school buildings and their impact we asked the following research question: Do educational leaders perceive indoor environmental quality, such as indoor lighting, less important than energy efficiency strategies?

Many decisions are made during the design and construction of green schools. Although the decisions about green building can be complex, in the absence of other considerations, the drivers for decisions are energy efficiency (cost) and indoor environmental quality (functionality and aesthetics). We interviewed 5 kindergarten through 12th grade (K-12) educational leaders from different geographical areas in to answer the research question. Additionally, this study utilized policy, in terms of existing models or concepts that have been gathered from the literature. The interviews were summarized and the interviewees' responses were coded with the decision drivers they identified.

Green Building Policy

Many school facilities have poor indoor environmental conditions that may result in increased health risks for students, as well as inhibited learning and student

performance. The initial research about how building occupants are affected by the building's lighting began in the 1960's. Soon after, advocacy coalitions for improving facilities design began what has now turned into the movement for green schools.

Advocacy policy change is a temporal process that focuses on policy subsystems, intergovernmental aspects, and public policies. (Jenkins-Smith and Sabatier, 1994). The temporal change process typically takes at least a decade and has successes and failures dependent on the advocacy and on external factors. Advocacy coalitions have both a top-down and a bottom-up perspective. The policy subsystem focuses on multiple levels and not a single institution, but is found in various arenas. The intergovernmental aspect is typically broad, stemming from the local grass roots level all the way up to the federal level. The public policies aspect typically corresponds to belief systems by being theory based, and prioritizes values and incorporates perceptions.

In the early 2000's there was a spike in oil prices to nearly $80 a barrel, heating and energy costs soared and there was seemingly no end in sight for these increases (Rothenberg, 2006). This created a large punctuation which stimulated quick decisions toward green building policies. Scholars have employed the punctuated-equilibrium theory to understand a variety of policymaking situations (Baumgartner, & Jones, 2009). Practitioners have cited punctuated-equilibrium theory as a policy theory that can quickly change in the face of accumulating factual evidence (Speth, 2004).

The convergences of the advocacy coalition and the external factor of punctuated-equilibrium have created a "policy window". This policy window has been explained as the multiple streams theory developed by Kingdon (1984). Theoretically, this window is open and the 21st Century Green High-Performing Public Schools Facilities Act could have a positive impact on the health and performance of students and assist with keeping the policy window open longer. The 21st Century Green High-Performing Public School Facilities Act is broad in design and allows educational leaders flexibility in their decisions about the sustainable design elements they decide to incorporate as part of the grant.

The 21st Century Green High-Performing Public School Facilities Act "Directs local education agencies (LEAs) grantees to use a percentage of their grant, rising in 10% increments from 50% in FY2010 to 100% in FY2015, for public school modernization, renovation, repairs, or construction that meet Leadership in Energy and Environmental Design (LEED) green building rating standards, Energy Star standards, Collaborative for High Performance Schools (CHPS) criteria, Green Building Initiative environmental design and rating standards (Green Globes), or equivalent standards adopted by the entities that have jurisdiction over such LEAs. Requires the Secretary to provide outreach and technical assistance to states and LEAs concerning the best practices in school modernization, renovation, repair, and construction" (govtrack.us, Section 309, 2009). Some of these standards are associations that have been formed due to years of advocacy coalitions for green building and are specifically for schools and student performance.

Lighting and Student Performance

Lighting is one of the main design elements of green building. It is used as a justification for building green schools because of the impact on energy use and student performance. Lighting has been determined to be a contributing factor to a school building's overall indoor environmental quality.

The Heschong Mahone Group (1999) prepared one of the most detailed studies investigating the relationship between daylighting and student performance for Pacific Gas & Electric and the California Board for Energy Efficiency. Their data set included over 21,000 students in more than 100 schools and they found a positive and significant correlation between the presence of daylighting and student performance. The three school districts in the study were located in Orange County, California, Seattle, Washington, and Fort Collins, Colorado. In a one-year study at Orange County's Capistrano school district, student's with the most daylight in their classrooms progressed 20% faster in math, and 26% faster in reading than students with the least amount of daylight in their classrooms. The results also indicated that views out of windows increased performance by 5 to 10%. The three school districts that were analyzed have different teaching styles and curricula, different building designs, and different climates, which helps validate the study because all of the results were similar. Yet, there was not a peer review on the study and it was criticized for not controlling teacher quality. The Heschong Mahone Group (2003) published a re-analysis of the report to address any concerns in the validity of the study as it relates to better teachers being assigned to daylighted classrooms and the aggregation of data across four grade levels. The peer review panel was satisfied with the methodology and rigor of the statistical analysis. They concluded: students in classrooms with the most daylight had 21% higher learning rate performance compared to the least amount of daylight, there was no teacher assignment bias to classrooms, daylighting effect does not vary by grade, and physical classroom characteristics such as daylighting, operable windows, air conditioning, and portable classrooms are not associated with absenteeism.

Due to material and design changes that include energy-efficient windows and skylights, along with renewed positive psychological and physiological effects of daylight, there has been an increase in interest in daylight in schools (Benya, 2001). The advocacy groups are also pointing out energy efficiency as an additional benefit of daylighting.

Energy Efficiency

Indoor environmental quality is not the only reason for lighting strategy design. A recent study of a middle school in North Carolina indicated an energy savings of 50% in lighting and 11% of total building energy reductions through daylighting. About 60% of the building's total square footage is provided with natural daylighting as compared to a code compliant building without daylighting utilization (Eckerlin et al., 2007).

Interviews

We presented research about lighting and its' impact on student performance and discussed generally the long term economic benefits of green building energy efficiency strategies to each interviewee. We then discussed the green building portion 21st Century Green High-Performing Public Schools Facilities Act. The educational leaders were then asked hypothetically, "Given the information on energy efficiency green building methods, and lighting and its' impact on student performance, how would you prioritize your decisions of energy efficiency or lighting strategies if awarded grant funds from the 21st Century Green High-Performing Public Schools Facilities Act.?" They were also asked about what information they would use to guide their decisions.

Results

All five educational leaders perceived energy efficiency strategies to outweigh the health and student performance benefits of indoor environmental quality, including lighting.

The educational leaders felt the decision to strictly reduce energy consumption and reduce their operating costs took precedence over student performance. The educational leaders seemed very skeptical of the research that correlated daylighting to student performance. One educational leader asked to see a follow up study to see if the findings of the Heshchong Melone study were still similar or if the results could be categorized as a Hawthorn effect. Another educational leader requested that they would like to see a side by side comparison of the student performance based on daylighting verses the student performance that would result from more teachers and smaller class sizes, more textbooks and computers. Additionally, the schools evaluated were in affluent areas, raising questions about the lack of socioeconomic considerations in the study's published results. All of the educational leaders interviewed were familiar with the general long-term economic benefits of utilizing energy efficiency strategies when building green. Overall, they felt that by spending the money on strategies that increase energy efficiency, such as solar panels, a school could reduce their building's energy costs for the life of the building. The savings could be used for other ways to improve student performance. In fact, one respondent suggested that energy savings from solar panels could lead to class size reduction, the purchase of new instructional technology, or the faculty and staff could be allowed more time for training. All the educational leaders interviewed revealed they would look to the faculty and staff to improve the students' performance and to the building to reduce overhead.

Discussion

Currently, there are a number of green building programs from which educational leaders may choose and still be in compliance to receive grant monies. Not all of the green building programs incorporate the same prescriptive method for daylighting.

For example, Energy Star discusses how to lower cost and be more cost effective and discusses student performance as a byproduct of daylighting (Energy Star, 2009).

Based on the educational leaders' perception, the research base does not have the depth and breadth that is needed to use student performance as a justification for investing in green building strategies. By providing more sound research, the advocacy coalitions may be able to broaden and expand the policy window beyond the recent punctuation. This may add long term viability to the green building advocacy coalitions. The main study that is referenced by all advocacy groups was performed by a consulting group for PG&E. Although this study was eventually peer reviewed, it did not appear to be sufficient to sway the perceptions of educational leaders.

We argue for additional research that further substantiates the link between improved daylighting and student performance. Additionally, while it is important for the advocacy coalitions to broaden, more standardization among them is necessary. The use of the additional research relating to daylighting and student performance can then be used for the advocacy groups to develop standards that are widely accepted. The standardization in lighting among the advocacy groups may help to permanently define and standardize green building policy. There is little resistance to federal, state and local municipality adoption of green building, but specific definitions and standards of green building are lacking. Without standardization, the use of student performance as justification for green building may become a passing fad. Not only may lighting standards slip away, but many other ancillary components of green building in today's school systems may as well. If the advocacy coalitions unite and standardize their certification programs, then the federal, state and local municipalities may only have one method to certify and implement green building in our schools. This may eventually lead to the adoption of these design and building methods into building codes, which would go beyond policy and result in a standard method for building schools which incorporate all of the green building methods. With building code adoption there may no longer be the need to use justification to build green schools, as it will be mandated. This standardization in the building codes would eliminate the loosely coupled policy system that allows federal standards to trickle down to local education authority to make green building decisions based on their agendas. Although the fad will be gone, the actual proper installation of lighting may remain, without the need for justification.

Conclusion

The educational leaders' interviewed in this study perceived energy savings strategies to be more important than indoor environmental quality in the design and construction of new schools. A potential area for further research would be to study the decisions made about green building strategies during the design and construction of schools that received money from the 21st Century Green High-Performing Public School Facilities Act.

References

Baumgartner, & Jones, T. (2009). "Agendas and instability in American politics." *Policy Subsystems, Punctuated Equilibrium, and Theories of Policy Change*, The University of Chicago Press, IL, 255-285

Benya, J. R. (2001). "Lighting for schools." *National Clearinghouse for Educational Facilities.* <http://www.edfacilities.org/pubs/lighting.pdf> (Jan. 31, 2011)

Eckerlin, H., Manning, M., Umesh, A. & Zubizarreta, J. (2007) "A New Daylighting Strategy for a Middle School in North Carolina." *Innovative Design,* <http://www.innovativedesign.net/pdf/141P.pdf> (Jan. 31, 2011)

Energy Star (2009). "Schools: An Overview of Energy Use and Energy Efficiency Opportunities*" Energy Star Schools*, <http://www.energystar.gov/ia/business/challenge/learn_more/Schools.pdf> (June 9, 2009)

Govtracks (2009). "H.R. 2187: 21st Century Green High-performing Public School Facilities Act." *Congressional Research Service,* <http://www.govtrack.us/congress/bill.xpd?bill=h111-2187&tab=summary> (June 6, 2009)

Heschong Mahone Group (1999) "Daylighting in Schools, An Investigation into the Relationship Between Daylighting and Human Performance." Fair Oaks, CA, <http://www.coe.uga.edu/sdpl/research/daylightingstudy.pdf> (March, 14, 2010)

Heschong Mahone Group (2003). "Daylighting in Schools: Reanalysis Report." Fair Oaks, CA, http://newbuildings.org/sites/default/files/A-3_Dayltg_Schools_2.2.5.pdf (December 14, 2011)

Ingram, H.M. & Mann, D. E. (1989). "Interest groups and environmental policy." *Environmental policy and politics, theory and evidence.* Durham. NC: Duke University Press Duke University Press, pp. 135-157

Jenkins-Smith, H., & Sabatier, P. (1994) "Evaluating the Advocacy Coalition Framework." *Journal of Public Policy.* 14(2), 175-203.

Kingdon, J. (1984). "Agendas, alternatives, and public policies." Little Brown & Co., Boston.

Rothenberg, P. V. (2006). "Seeing green: a green building revolution is inspiring legislation, forcing property managers to take note." *Journal of Property Management*, 71(5), 18.

Speth, Gustave (2004). "Red Sky at Morning." New Haven CT: Yale University Press.

U.S. Green Building Council, (2009). "USGBC." *What is LEED,* <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1988 > (March 17, 2009)