Green Building and Universal Design Decision-Making of Educational Facilities in a Multiple Stakeholder Environment

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Abstract Title

This research is a retrospective case study designed to document the green building and universal design decisions made by the project delivery team and stakeholders. For this study, project delivery team members and key stakeholders agreed to extensive interviews about the decisions made during the design, construction, and post occupancy phases of two new major public educational facilities. The design and construction of public education facilities represent a significant opportunity to study multiple stakeholder decision-making in complex public organizations. Moreover, from a practical standpoint, such research might be particularly useful for addressing rapidly emerging trends in development and deployment of green building and universal design decisions. Each step of the project delivery process typically requires many decisions, which can often be complex. In the absence of other considerations, however, the final drivers of decisions are cost, function, and aesthetics. This study used a retrospective case study as part of an exploratory qualitative research strategy for examining the multiple stakeholders involved in the decision-making that occur in complex public organizations. This study was aimed at documenting some practical features of the actual decisions made in this particular case. Results indicate project delivery team members', their characterization of the primary decision driver, and the decisions made related to green building and universal design in educational facilities.

Keywords: multiple stakeholder decision-making, green building, universal design, higher education organizations, educational facilities

1. Introduction

Often times, an important first step for architects and constructors is gaining an understanding of their client prior to beginning the design and construction of new facilities. Educational leaders are many times the decision makers for the client in the design and construction of new public educational facilities. Educational organizations require educational leaders with the ability to not only see what is required in the present but also to have a vision for the future and to make the decisions necessary to meet future needs (Razik and Swanson, 2010). Additionally, educational organizations are complex. The

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complexity of these organizations may add challenges to the architects and constructor's ability to understand who the decision makers are and what is driving their decisions about green building and universal design. Decision making in complex organizations, such as universities, involves many people who represent a diversity of constituencies, i.e. multiple stakeholders (Brazer and Keller, 2006). Some of these stakeholders may be from outside the university's organization while others exist within the organization, creating added complexity to the organization and decision making process.

The process of making decisions is a major and frequent aspect of leadership in educational organizations. Literature on organizational effectiveness in education listed improving the quantity and quality of resources as one of the three variables that help students reach high standards (Corcoran and Goertz, 1995). An educational facility is a prime example of one of these resources. Educational leaders' guidance in the decision making process may create the conditions under which stakeholders can recognize the importance of classroom design and an improved use of resources (Corcoran and Goertz, 1995). The design and construction of educational facilities has an impact on the teaching and learning that take place in the completed facility – an important factor because an education organization's core goals center on teaching and learning. These decisions are high stakes decisions because of the relative performance of the outcome of these decisions. Once an educational facility is constructed, it is difficult to make changes to the decisions made about its' design. These decisions are many times permanent and are literally grounded in concrete for an indefinite period of time.

An educational leader may plan for, or participate in, the building of a new educational facility only once in his or her career, if that. Therefore, many educational leaders do not have training in managing the planning process of new school facilities. When decisions deviate from routine, educational leaders seek information from multiple stakeholders prior to making decisions (Brazer and Keller, 2006). Many times, these stakeholders have multiple objectives with varying degrees of influence and collaboration that impact the decision making process (Brazer and Keller, 2006).

Many university communities include different people involved in different decisions, from teachers and students to the community. Due to university bureaucracy, the decision-making process seems to defy "logical" decision-making models (Reitz, 1987). Educational leaders could face an endless number of decisions, and many decision-making models lack the conceptualization of decision-making processes that link theory with practice (Brazer & Keller, 2006). Recent literature has recognized voids in educational decision making and has created areas of inquiry out of these voids to develop a model that future researchers can apply. The general conceptual framework focuses on multiple stakeholders, levels of collaboration, "the concept of coupling between decision makers and stakeholders, and feedback in many different directions as decisions evolve" (Brazer & Keller, 2006, p. 2). Different organizations within the university are parts of a system that have linkages, or couplings, to each other. Some of these couplings are tight and some are loose, meaning that directives and actions are not always linear (Brazer & Keller, 2006). An example of this in the university setting would be the university educational leaders who may not always understand the mission of each individual college's specific goals for teaching and learning.

Often, educational facilities in higher education are designed 5-10 years in advance of actual construction. With timelines this long, emerging trends are rarely considered, much less planned. This typically leads to decisions made about changes in the design of educational facilities throughout the project delivery process. Design decisions based on emerging trends, such as green building and universal design, are not easy decisions to make. This can be even more challenging when there is a team of people involved in decisions that may have different drivers for making their decision making.

This study used a retrospective case study as part of an exploratory qualitative research strategy for examining who the key decision makers were in the multiple stakeholder environment that involved the decision-making of two new green public education facilities. This paper is empirical in design as it is intended to specifically focus the decisions made about green building and universal design. Practical features of the actual decisions made during the design, construction and post occupancy phase were documented and are reported. Additionally, this study describes the project delivery team members' characterization of their primary decision drivers. Each step of the project delivery process typically requires many decisions, which can often be complex. In the absence of other considerations, however, the final drivers of decisions are cost, function, and aesthetics.

1.1 Green building and universal design

Green building is an important area educational leaders need to understand in order to make decisions about the design and construction of educational facilities (Earthman, 2009). Historically, until the latter part of the 20th century, the majority of educational facilities were constructed with minimal concern for their impact on the environment (Earthman, 2009). A combination of events led to the current trend of green facilities. The movement to construct high-performance "green" facilities has experienced unprecedented market growth and continues to become a more mainstream practice for constructing schools in the United States.

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). A recent study interviewed K-12 educational leaders' and found they perceived energy savings strategies to be more important than indoor environmental quality in the design and construction of new schools (Kelting and Montoya, 2011) even though indoor environment quality such as thermal comfort, indoor air quality, acoustics and lighting correlate with an improved learning environment (Bosch, 2006).

Due to the increasing diversity of people in the higher-education environment, facility designers have become aware of the importance of applying universal design concepts to

create an inclusive environment. Diversity has extended beyond gender and nationality to include physical differences as well (disabilities). This transition has brought awareness that the facility should be accessible to all students. Universal design generally extends beyond building codes due to the benefits educators have found. Four areas to consider as best practices when including universal design into the project delivery process are general design standards and processes, site and facility planning, facility systems, and functional areas (Tepfer, 2001). Participatory design is an example of a general design standard that allows educators to voice their opinions on student needs during the design of the facility. Examples of site and facility planning include the building's location on the campus and its orientation on the site in relation to the existing built environment. Accessible routes for everyone to enter the facility serve as the foundation of site planning and selection. Indoor environmental quality is an example of facility systems the universal design should take into account. Both acoustics and indoor air quality are examples of the indoor environmental quality. Finally, classrooms are prime examples of the functional areas the design process should include.

1.2 Decision drivers

The recent economic climate in the United States of America makes the cost of new higher-education facilities increasingly important. Educational facilities need to meet minimum requirements mandated by federal and local jurisdictions. Many educational leaders and stakeholders have goals to design above and beyond these minimum requirements to provide a more effective space for learning to occur. Educational leaders and stakeholders must make decisions on the appropriate way to spend the money allocated to the facility. Different individuals in these groups may have differing opinions and different decision-making criteria on the best use of the money allocated to the new facility. For example, the educational leaders and multiple stakeholders may have differing opinions about whether function or aesthetics is more important. A person concerned about facility operational costs, for instance, may want fewer windows in the design of the facility to lower energy costs. Other decision makers may have more concerns about the facility's aesthetics and therefore want to add more windows to improve its appearance from both the exterior and interior. Another decision maker may also want more windows for the function of creating more daylight, ventilation, and views for learners. These conflicting perspectives may drive decisions on spending.

The facility's function hinges on many factors, including the ability to accommodate the activities that will take place within the facility and the facility's ability to accommodate the diverse student body in a safe environment. One of the main functions of a higher-education facility is to improve student learning, however. This function breaks down into many different areas: the location and orientation of the facility, the indoor environmental quality (e.g., lighting, thermal comfort, and indoor air quality), and the furnishing and equipment (e.g., desks, computers, projectors, and storage areas).

Although cost and function are important, the facility's aesthetics also play a crucial role. Many facilities are designed to remain consistent with or complement their surroundings, making them places that please the general public. Interior finishes and exterior finishes

(e.g., paint, tile, window coverings, and exterior siding) are often a high priority for educational leaders and stakeholders involved in the decision-making process. This fact often becomes particularly evident with owners and with facility occupants who may influence or take part in the owner's decision-making process. One of the main reasons interior and exterior finishes are a driving factor in decision making is that they impact perception of the facility's overall quality. The quality of the facility also depends on aspects not visible at the end of construction (e.g., structural integrity, mechanical and electrical systems, plumbing, and exterior envelope); the perception of quality may center on these finishes, however, making them a driver of many decisions.

2. Methodology

This retrospective case study is designed to research and analyze the decisions made on the design and construction of a new higher-educational facility, as characterized by the educational leaders and stakeholders. This study is retrospective because it studies the decisions that have already been made during the project delivery of completed educational facilities. The central instrument for data gather was semi-structured interview with a set of guiding questions.

A preliminary investigation assisted the researcher with identifying the primary decision makers during the design and construction of the selected higher-education facility. Merriam (2009) refers to network sampling as a type of investigation wherein interviewees refer the researcher to other potential interviewees for the study. The researcher used network sampling by starting with the previously identified interviewees and listened keenly for other people who may have played a key role in the educational leaders' decision-making process that would add to the findings of this study. If the following conditions occurred during an interview, the researcher made a decision to interview additional people accordingly: The interviewee mentioned someone as a key influencer in the educational leaders' decision making, and these individuals were willing to participate in the study. Two interviewees gave contradicting information, which led the researcher to interview a third party to sort out the contradiction. An interviewee provided insufficient detail and referred the researcher to another source for additional information.

The researcher created and read transcripts from the interviews and then color-coded the transcripts to identify all the responses that pertained to decisions made by the interviewees. The researcher extracted this information from the transcripts by quoting and summarizing the interviewees, then subsequently organizing this information organized by phase, organization, green building and universal design. After creating tables to summarize all documented decisions, the researcher coded the tables with the decision drivers of cost ("c"), function ("f"), and aesthetics ("a")

This research took place at a completed four-year university facility in the United States that has been occupied within the past two years. These two four-story facilities both obtained a Leadership in Energy and Environmental Design (LEED) Silver certification and used a design-bid-build project delivery approach. One facility was designed and constructed for education faculty and students and the other was designed and constructed for social

science faculty and students. To maintain confidentiality, this study used pseudonyms for the two buildings: Building A for the education building and Building B for the social sciences building. Each of the facilities has a floor plan designed to accommodate the specific use of the facilities for the goals and missions of its occupants.

3. Research Questions

Many times the educational leaders are the final decision makers and do not have training to manage the planning process of new school facilities. The lack of training provided for many of today's emerging trends, such as green building, creates a larger need for educational leaders to seek information from multiple stakeholders prior to making decisions. Who are the numerous people participating in the decisions over time? What drives the decisions educational leaders and stakeholders use to make decisions about green building? What decisions do they make? The answers to these questions may be useful for educational leaders who may be involved in future projects. In addition, this information may assist the multiple stakeholders understand the decision making environment of universities. To answer these questions, this study described the decisions made about the emerging trends of instructional technology.

This study attempted to answer the following questions:

1. Who are the key decision makers and stakeholders?
2. What decisions were ultimately made (during the design, construction and postoccupancy phases), relative to green building and universal design, as characterized by the educational leaders and stakeholders at a higher education institution?
3. How did the educational leaders' and key stakeholders' characterize their primary reasons for green building and universal design decision making?

4. Results

The educational leaders originally selected for interviewing were the dean and assistant dean from Building A, as well as the associate vice-chancellor and facilities manager from the university's campus design and facilities department. The key stakeholders identified were the architect, and the constructor. The network sampling led the researcher to additional interviewees. The people identified were from Building B, the university's Office of Budget and Planning, and the Design and Facilities Department. The network sampling revealed that key decision makers from Building B were part of the overall project and part of the decision-making process. The individuals recognized as playing a key role in the decision-making process in Building B were the provost, and the three deans from different units within the college. Only one of the three deans participated in the study. The university employee identified as playing a key role in the decision-making process was the director of design and construction. The interview process for both buildings uncovered a complex web of additional stakeholders, including additional staff, the fire marshal, the building inspector, Building A and B's information technology directors, donors, the university's board of directors, faculty, and students. The researcher created a table that summarized the decisions made by each organization and coded each decision by phase (see table 1).

Table 1: Summary of Design Decisions Made about Green Building and Universal Design as Characterized by Building A, Building B, and Entire Project Respondents

Respondent/Organization	Decisions Made About Green Building
Building A	LEED Certification (F) Natural ventilation with operable windows (F) Daylighting (F) Outdoor learning garden (F) Addition of window coverings (F)
Building B	LEED Certification (F) Natural ventilation with operable windows (F) Lack of life-cycle analysis (C) Addition of window coverings (F)
Entire Project	LEED Certification (F) Natural ventilation with operable windows (F) Outdoor learning garden (F) Low volatile organic compound paints, carpet, and landscaping (F) Installation of Marmoleum flooring (F) Installation of Cherry Wood Handrails (A)
Respondent/Organization	Design Decisions Made About Universal Design
Building A	Central entrance (F) Public social spaces (F) Clear circulation or way-finding (F) One elevator (C)
Building B	Two elevators (F) Corridor widths (F)
Entire Project	One elevator for Building A (C) Two elevators for Building B (F) Toilet layouts (F) Corridor widths (F) Meet building code (F) Unclear circulation in building B and clear circulation in building A (F)

The researcher created an organization chart displaying the various key decision makers (see figure 1).

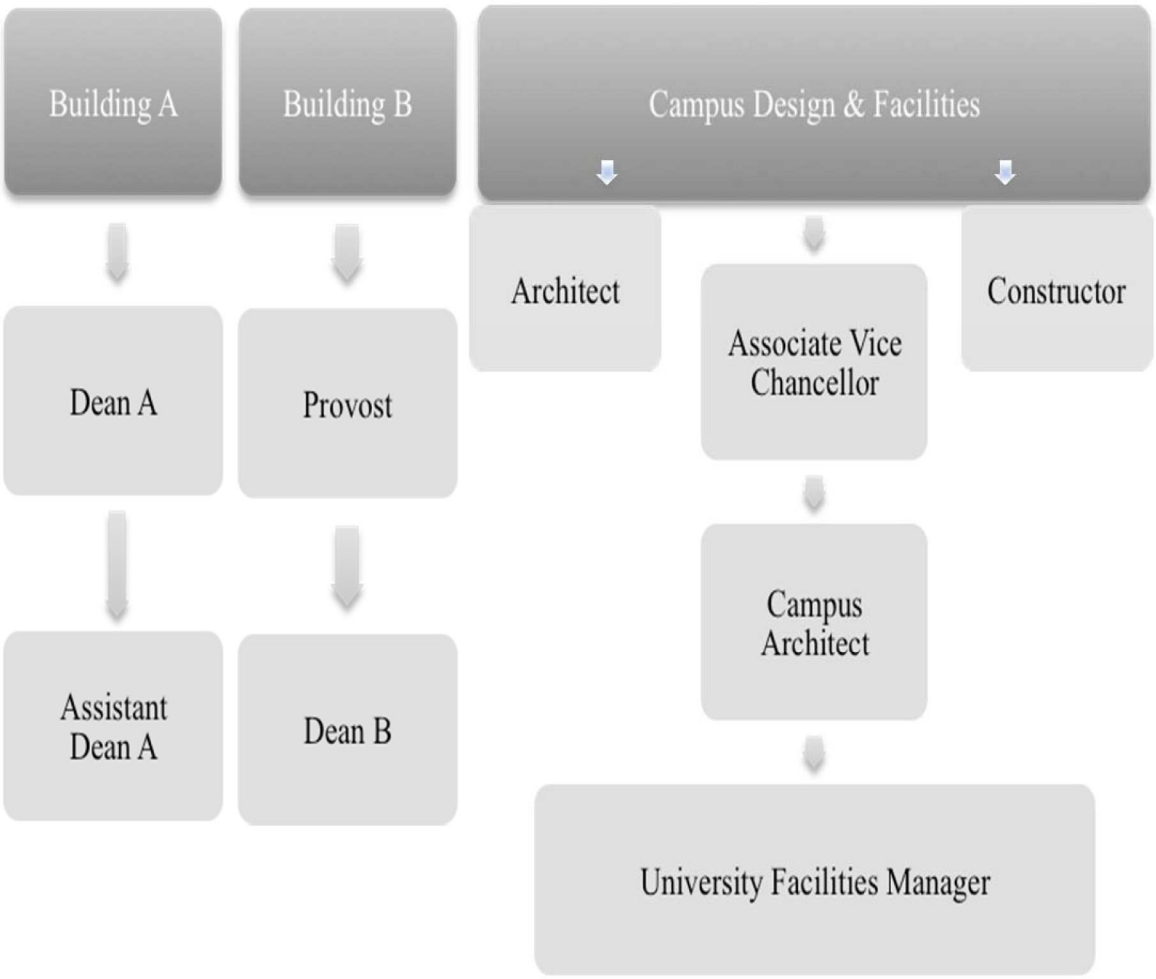

Figure 1: Decision Makers and Their Drivers for Green Building Decisions

5. Discussion

Three complex organizations emerged from the data. The first two organizations are Building A and Building B with the educational leaders and stakeholders specifically associated with each building. Building A was a small organization with one dean and two departments. Interviewees characterized Dean A as having provided a vision for the decisions made in a collaborative process. Building B's organization was much larger than that of Building A, with a history of department advocacy, and therefore more complex. The interviewees characterized the decision-making process as top down, and they described little collaboration. The third organization included educational leaders and key stakeholders who were not associated with either building but were involved in the decision making for the entire project. This organization is called the Design and Facilities Organization.

Not every educational leader has the ability to provide a vision for an organization that will guide the decision making process to meet future needs. The associate vice chancellor reported that Building B did not have a central vision and Building A did. The associate vice

chancellor discussed that it has not been the university's policy to provide guidelines for the learning spaces of new educational facilities. As a result of Building B's final design, the associate vice chancellor has established four additional architectural guidelines to assist with providing a central vision for future projects: 1) central lobby with an identifiable front door, 2) clear circulation to help create an easily navigable building, 3) social spaces for the faculty, staff, and students, 4) and an outdoor learning garden that aligns with the building's purpose. These guidelines are a part of the university's physical design framework which provides guidelines to educational leaders and stakeholders involved in the decision making process of new educational facilities.

The educational leader decision making process for "Green building" refers to the LEED silver certification. LEED certification aims to improve three areas: 1) energy, water, and atmosphere reduction; 2) improved indoor environmental qualities; and 3) a stewardship to resources and their impact (USGBC Research, 2009). The data analysis found the green building decision making processes and the decisions to be relatively the same. The researcher attributes this to the decision support system of the LEED rating guidelines that were used. Both Building A and B were part of the same LEED rating guidelines used to make design decisions for the entire project.

The researcher was surprised that the primary decision driver for both buildings was functionality. However, Dean B indicated that the green decisions did not take into account life cycle cost analysis of the building. One advantage of green building is energy efficiency. Many times, achieving high levels of energy efficiency comes with upfront costs.

To learn about the impacts multiple stakeholder decision-making has on future higher-education facilities the researcher recommends a post occupancy evaluation of the facilities in this study as further research. This recommendation for future research resulted from some of the respondents' characterization of the end product expressed during the interviews. Assistant Dean A said, "I would say, 'knock on wood, but there's been very few complaints." However, the researcher was approached by other occupants who learned about this study and one mentioned that the natural ventilation resulted in uncomfortable conditions because the rooms reached temperatures that were too warm. As a result, blinds were purchased for the windows. Site visits revealed that these blinds were often times closed during the day, which eliminated the both the views, and the natural daylight that was originally designed for the new green educational facilities

6. Conclusion

This study identified who the key decision makers were in the multiple stakeholder environment that involved the decision-making drivers of two new green public education facilities and documented some practical features of the actual decisions made during the design, construction and post occupancy phase. The primary decision driver was functionality. The network sampling utilized in this study identified a multiple stakeholder environment that included architects, constructors, and many educational leaders from different organizations within the university as being key decision makers about green building. The methods used to better understand the complexity of these organizations in

this particular case study may be utilized by both architects and constructors to assist them in understanding who the decision makers are and what is driving the decisions about green building and universal design. Not every educational leader has the ability to provide a vision for an organization that will guide the decision making process to meet future needs. The associate vice chancellor reported that Building B did not have a central vision and Building A did. The associate vice chancellor discussed that it has not been the university's policy to provide guidelines for the interior spaces of new educational facilities. As a result of Building B's final design, the associate vice chancellor has established four additional architectural guidelines to assist with providing a central vision for future projects

References

Bosch, S.J. (2006). Research priorities: how facilities affect Learning Outcomes. In Tanner C.K. and Lackney, J.A., Educational Facilities Planning: Leadership, Architecture, and Management, Boston, MA: Pearson Education, pp. 323-49

Brazer S. D., & Keller, L. R. (2006). A conceptual framework for multiple stakeholder educational decision making. International Journal of Educational Policy & Leadership, (1), 3.

Corcoran, T. & Goertz, M. (1995). Instructional capacity at high performance schools. Educational Researcher, 24(9) 27-32.

Earthman, G., (2009) Planning Educational Facilities. (3rd Edition). Lanham, MD: Rowman and Littlefield Education.

Kelting, S., Montoya, M. (2011). Green Building Policy, School Performance, and Educational Leaders' Perspectives in USA, Construction in the 21st Century International Proceedings of the 6th Annual Conference.

Merriam, S. B. (2009). Qualitative Research, A Guide to Design and Implementation. San Francisco, CA: Jossey-Bass Publishers.

Razik, T., & Swanson, D. (2010). Fundamental Concepts of Educational Leadership and Management. 3rd Editio

Tepfer, F. (2001). Educational Environments: From Compliance to Inclusion. In: Preiser, G. & Ostroff, E. (2001) *Universal Design Handbook*. Boston, MA: McGraw-Hill. Boston, MA: Allyn & Bacon.

U.S. Green Building Council Schools. Retrieved March 17, 2009 from: http://www.greenschoolbuildings.org/Homepage.aspx