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A post-occupancy evaluation of a green rated and conventional on-campus residence hall

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Abstract

Green buildings increasingly attract attention in the real estate sector, and the United States is no exception. Studies indicate that green rated buildings may bring higher rents and sales prices. One reason for this inequity is that the indoor environment of these buildings may outperform conventional buildings. The main objective of this paper is to conduct a post-occupancy evaluation (POE) to compare the indoor environment in a LEED certified, on-campus residence hall with a similar, non-green rated residence hall. Results are evaluated to determine if green buildings really outperform. The results suggest that the green rated building outperformed the conventional building in the majority of the indoor environmental aspects, but not all. These results can inform a cost-benefit analysis of green features for new construction and refurbishments.

Keywords: POE; Post-occupancy evaluation; Residence halls; Green building; Perceived indoor environment

1. Introduction

In the last decade, an interest in green, or environmentally preferred, building design has increased dramatically. The US Green Business Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification program reports that in 2005, only 2% of all non-residential building starts were green. By 2012, that number grew to 41% (Katz, 2012). As for residential buildings, the usage of the LEED for Homes scheme has also increased during the last couple of years. In 2007, the program was used to certify 392 housing units; this figure increased to more than 17000 housing units by 2013, and there are more than 82000 housing units seeking LEED certification (Kriss, 2014). However, in order for this positive trend to continue, these buildings need to be evaluated to determine if actual performance is in line with the predicted outcome. Such evaluations should include technical and economic performance, but also the experiences of occupants.

One way to study these questions is to perform a post-occupancy evaluation (POE), which is defined as "the examination of the effectiveness for human users of occupied designed environments" (Zimring and Reizenstein, 1980, p. 1). A POE assesses client satisfaction as well as

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the functional "fit" of a specific space, with focus on the occupants' needs (Zimmerman and Martin, 2001). Such investigations can clarify occupants' perceptions of the indoor environment as well as the building design, potentially leading to performance benchmarks. Further, each case study brings about a learning opportunity for all involved stakeholders (Turpin-Brooks and Viccars, 2006).

POEs have been conducted in both residential and commercial buildings, using various baselines and comparisons. Some studies focus on occupant satisfaction in and/or perception of green buildings (Armitage et al., 2011; Gou et al., 2012a; Wilkinson et al., 2013). Other studies emphasize the differences (if any) in the occupants' satisfaction in and/or perception of green and conventional buildings (Abbaszadeh et al., 2006; Gou et al., 2012b; Paul and Taylor, 2008; Zalejska-Jonsson, 2012). Still others examine a move from a conventional building/refurbishment of a conventional building to a green building (Agha-Hossein et al., 2013; Thatcher and Milner, 2012; Sustainability Victoria and Kador Group, n.d.).

Specific research into air quality and indoor temperature has varied results. Some studies find that the occupants of green buildings have an overall greater satisfaction with both air quality (Abbaszadeh et al., 2006; Gou et al., 2012a; Zalejska-Jonsson, 2012) and, under certain conditions, thermal comfort (Abbaszadeh et al., 2006; Gou et al., 2012a,b; Thatcher and Milner, 2012). On the other hand, some research indicates that for various reasons and at different times of the year, there is more dissatisfaction with the temperature in green buildings (Gou et al., 2012a,b; Paul and Taylor, 2008).

Satisfaction with lighting also varies across different studies. In some instances, there is no discernable difference in perceived lighting quality when comparing green and conventional buildings (Abbaszadeh et al., 2006; Paul and Taylor, 2008). However, other studies indicate less satisfaction with lighting in green buildings (Gou et al., 2012b; Thatcher and Milner, 2012).

It is important to note that an individual's beliefs about environmental sustainability and its' importance can impact the view of building performance. Paul and Taylor (2008) employ environmental psychology to discuss "place identity," which predicts that individuals with pro-environment beliefs are more likely to identify with green buildings. As a result, they are more likely to give high satisfaction ratings when occupying environmentally friendly structures. Similar findings indicate that individuals with an ethic of sustainability report higher overall satisfaction with green buildings (Monfared and Sharples, 2011) and are more likely to overlook shortages in green designs (Deuble and de Dear, 2012; Leaman and Bordass, 2007).

Some studies also discuss the building's influence on pro-environment beliefs and behavior. Armitage et al. (2011) notice a difference between managers' and employees' opinions of a green work place. While managers believe that working in a green rated building has a positive impact on the employees' behavior and attitudes from an environmental point of view, the employees' report that they do not believe that the work environment has any impact on their environmental awareness. When looking into the residential sector, Zalejska-Jonsson (2012) results indicate that green residential buildings have a positive impact on the residents environmental awareness and behavior. However, Wilkinson et al. (2013) could not find such a relationship in their study.

2. Sustainable residence halls

In 1990, college and university leaders from around the world convened in Talloires, France to discuss the intersections between higher education and sustainability. Their public declaration outlined that "universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies and tools to create an environmentally sustainable future" (Talloires Declaration, 1990). These university leaders were the first to collectively articulate the importance of addressing sustainability at institutions of higher education.

Since the Talloires Declaration, a rapidly increasing number of colleges and universities are working to infuse sustainability into policies and practices. Given their popularity, residence halls are one obvious conduit for greening a campus. The Association of College and University Housing Officers International estimates that over 2000 higher education institutions provide housing for over 2 million students (Torres-Antonini and Park, 2008).

2.1. University of Arizona Residence Life

As of June, 2014, there are 6546 permanent bed spaces and 174 extended housing spaces on the University of Arizona (UA) campus, spread between 22 undergraduate halls. The buildings were first occupied between 1921 and 2011, with five residence halls listed on the National Register of Historic Places and six built since 1990.

The most recent of these new buildings came from the Sixth Street Housing Project, which developed the Arbol de la Vida and Likins residence halls. UA policy dictates that new construction should seek at least LEED Silver certification. This project exceeded that expectation by producing two LEED for New Construction (v2.2) Platinum certified buildings.

After interviewing several UA employees intimately involved with this project, it is clear that the original intent was not to seek Platinum certification. Rather, the goal was to build structures that would provide the best possible environments and be durable enough to withstand the test of time and undergraduates. The team pursued all appropriate LEED credits, leading to the first LEED Platinum residence halls in Arizona.

In addition to new construction, UA Residence Life takes on regular renovation projects. Beginning in 2009,