

Keelan P., KAISER
Professor of Architecture
Judson College
Department of Architecture
1151 North State Street
Elgin, IL 60123

847 628 1013, 847 628 1008 (f), kkaiser@judsoncollege.edu

Title: A green studio pedagogy: using scale changes to influence architectural design for sustainability

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Authors: Keelan P. Kaiser, AIA

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A green studio pedagogy: using scale changes to influence architectural design for sustainability

Keelan P. Kaiser, AIA

Judson College, Elgin, Illinois

ABSTRACT: This paper discusses a design studio pedagogy which involves preparatory experiences in sustainable community design and sustainable technology as a means to inform subsequent architectural design. The paper speculates that influences at an urban scale and a detail scale can stimulate a holistic approach to the design process and allow the design student to think more broadly about sustainability. The process includes reflections on the new LEED – ND and its application in a design studio, precedent studies of high performance building façades and their formative effects upon preliminary massing and siting, and how these two types of investigations can broadly inform an approach to architectural design studio which strives toward sustainability.

Conference Theme: Education of Future Architects

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INTRODUCTION

This paper discusses a design studio pedagogy which involves preparatory experiences in sustainable community design and sustainable technology as a means to inform subsequent architectural design. The paper speculates that influences at an urban scale and a detail scale can stimulate a holistic approach to the design process and allow the design student to think more broadly about sustainability.

1. DESIGN STUDIO PEDAGOGY

Architecture design studio pedagogy involves a substantial amount of attention to design process. The faculty member assigns a studio problem partly to prompt motion toward a solution, and as often as not to begin the process of Bloom's Taxonomy (albeit adapted) of application, analysis, synthesis, and evaluation followed by a feedback to application. This cyclical process is a common approach for architecture studio pedagogy (Rowe 1991); and faculty members teach design through this iterative process. It is also a constructive process in that as the loop comes to completion, progress in the maturation of design work is expected. During the scope of a given project or term, a process is employed, somewhat linear though many times non-linear, from large scale considerations which narrow over time to more discrete scales (Figure 1).

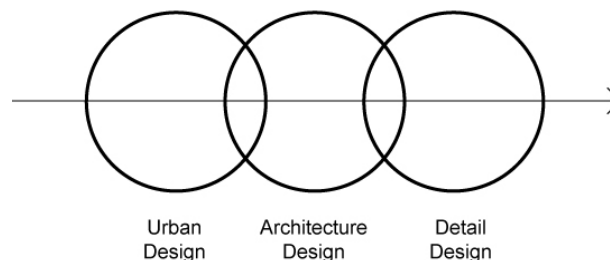


Figure 1: A common architecture design process. Source: (Author 2006)

While design process is seldom truly linear, it is not uncommon for urban scale or contextual considerations to preface architectural design decision making in some capacity or another. Likewise, it is often the case that design studio problems seek increased definition over time, and many times this takes the form of a detailed component of the design. The relationship of content from one arena to the other is substantial. However, in this

diagram, a relationship between the two outer circles is not necessarily synergistic, and may not be present whatsoever.

This paper describes a pedagogical approach in design studio which changes the order of the process as presented. The adjustment took an ecological look at the original diagram, and sought to feed relevant content into the design process from a combination of inputs: both urban and detail. The approach inculcated broad concepts of sustainable community with those of sustainable technologies prior to beginning the building design exercise itself. An adaptation of the previous diagram might read as follows (Figure 2).

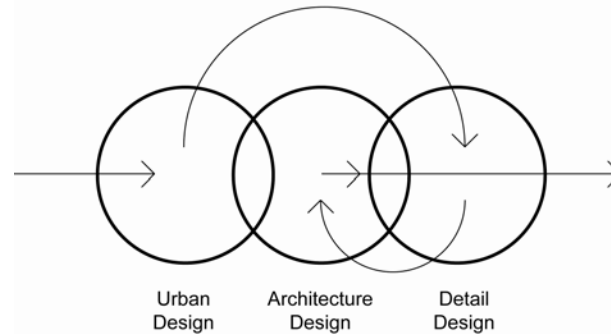


Figure 2: Adaptation of an architecture design process. Source: (Author 2006)

More specifically, the design studio conducted two investigations as a prelude to beginning building design. Sustainable community concepts found in the new Leadership in Energy and Environmental Design for Neighborhood Development (LEED – ND) was introduced first. LEED – ND was under review by the U.S. Green Building Council (USGBC) at the time that this design studio was offered (Fall, 2006), and is now in its pilot phase. It should be noted that many detailed changes were made to the working version in the newer pilot version, but the general scope remains largely the same. The students completed an urban neighborhood design exercise based upon the LEED – ND materials. Each student then researched contemporary precedents of high performance façades in an effort to understand contemporary applications of technology at their disposal to accommodate environmental and programmatic requirements. They created digital section models to document their negotiation of the assembly and systems at work in the precedents. The models also served as a visual taxonomy of contemporary building façade approaches. The pedagogical diagram is more appropriately labeled as such (Figure 3).

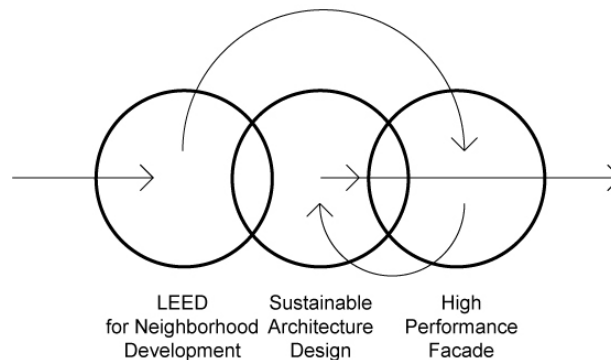


Figure 3: An alternative architecture design process. Source: (Author 2006)

This paper is concerned with outcomes and measurements of students integrating sustainability thinking into the formative stages of their design process. The assessment of this process is measured by the degree to which design students were able to understand and apply the sustainability concepts in the two preliminary investigations. Further assessments will be possible following the completion of the second studio in the sequence (Spring 2007) and will more specifically map the impact of these two formative investigations.

2. LEED – ND AS A VEHICLE FOR IDENTIFYING SUSTAINABLE COMMUNITY CONCEPTS

LEED – ND provided a basis by which to collect data about the downtown core, prioritize desired outcomes, and develop urban planning solutions suitable to the policies included therein. The USGBC describes LEED – ND as:

The U.S. Green Building Council, the Congress for the New Urbanism, and the Natural Resources Defense Council—three organizations which represent that nation's leaders among progressive design professionals, builders, planners, developers, and the environmental community—have come together to develop LEED for Neighborhood Development. This rating system will integrate the principles of smart growth, urbanism, and green building into the first national standard for neighborhood design. Whereas other LEED products focus primarily on green building practices, with only a few credits regarding site selection, LEED for Neighborhood Development will emphasize smart growth aspects and neighborhood design and development while still incorporating a selection of the most important green building practices. Guided by the Smart Growth Network's ten principles of smart growth and the Charter for New Urbanism it will include compact design, proximity to transit, mixed use, mixed housing type, and pedestrian- and bicycle- friendly design. In short, LEED for Neighborhood Development will create a label which could serve as a concrete signal of, and incentive for, better location, design, and construction of neighborhoods and buildings. Source: (USGBC 2007)

Serving as a municipal client, the Elgin Downtown Neighborhood Association director provided key guidance on city needs, in particular the neglect of the entry corridors to the city core, which ultimately became the focus of this particular study. The studio prioritized the potential points available for LEED certification and developed a summary to guide their design decision making. The categories of *Location Efficiency* and *Compactness* tend to address planning for density and connectivity principles while those of *Environmental Preservation* and *Resource Efficiency* tend to address technology and engineering (Table 1).

Table 1: A prioritization of LEED – ND point's based upon impact. Source: (Author 2006)

Location Efficiency (2 Prerequisites / 7 Credits / 28 Points / 25% of total points)	
Credit: Contaminated Brownfields Redevelopment	4
Credit: High Cost Contaminated Brownfields Redevelopment	1
Credit: Adjacent, Infill, or Redevelopment Site	3 to 10
Credit: Reduced Automobile Dependence	2 to 6
Credit: Contribution to Jobs-Housing Balance	4
Credit: School Proximity	1
Credit: Access to Public Space	2
Environmental Preservation (5 Prerequisites / 11 Credits / 13 Points / 11% of total points)	
Credit: Support Off-Site Land Conservation	2
Credit: Stormwater Treatment	2
Compact, Complete, & Connected Neighborhoods (3 Prerequisites / 22 Credits / 42 Points / 37% of total points)	
Credit: Compact Development	1 to 5
Credit: Diversity of Uses	1 to 3
Credit: Housing Diversity	4
Credit: Comprehensively Designed Walkable Streets	2
Credit: Superior Pedestrian Experience	1 to 2
Credit: Transit Subsidy	3
Resource Efficiency (0 Prerequisites / 17 Credits / 25 Points / 22% of total points)	
Credit: Certified Green Building	1 to 5
Credit: Energy Efficiency in Buildings	1 to 3
Credit: Water Efficiency in Buildings	1 to 2

The studio created an urban re-development proposal entitled *The Four Entry Corridors Study* which included strategies for encouraging increased density and future development along the four primary entry corridors to the Elgin, IL downtown which included: Route 31 from the north and south, Villa Street from the southeast, and Dundee Avenue from the northeast. The studio investigated how urban planning, urban design, and architecture can be used to improve the appearance and perceptual quality of a blighted downtown core and its primary vehicular circulation routes. Specifically, the study focused on the primary vehicular entry corridors and proposed increased investment and density as a solution to the overall vibrancy and sustainability of the City of Elgin (Figure 4).

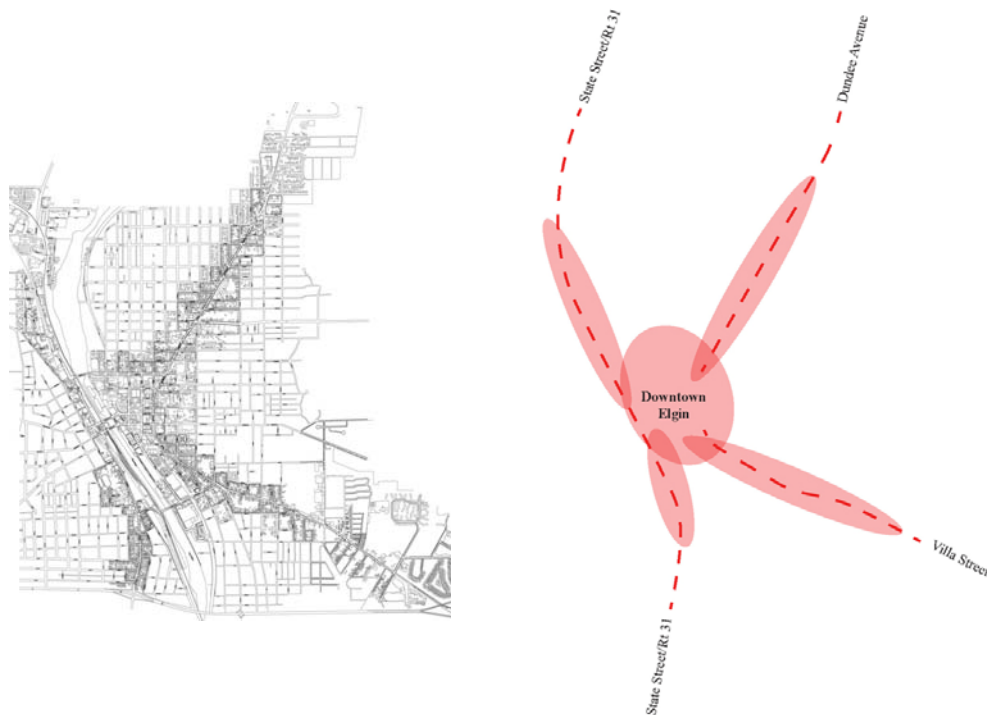


Figure 4: Elgin downtown core and primary entry corridors diagram. Source: (Author 2006)

The proposals combined ongoing capital investment and beautification efforts in the downtown core with significant capital investment along the corridor routes as alternatives to continued suburban sprawl and periphery development of green fields. The later types of developments are rampant in the northwest suburbs of Chicago and troubling given that Elgin is projected to be the fourth largest city in Illinois by 2030. The recommendation by the studio, supported by numerous case studies from other cities, is that density is a good, healthy, and more sustainable development approach.

The following findings were developed through teamwork and individual solutions. First, public and private investment in and re-urbanization of the downtown core and the entry corridors will significantly improve the visibility and sustainability of Elgin in the twenty-first century. Second, the four entry corridors in this study have the highest daily vehicular traffic counts and bring the largest volume of people in and through the downtown core. The corridors themselves bear a significant opportunity to affect the visibility and sustainability of the Elgin. Third, while notable developments and improvements abound on the periphery of the Elgin, a significant negative consequence is continued suburban sprawl. Instead, greater attention should be paid to significant re-urbanization of the downtown core and the extensions of the core that fall along the four primary vehicular corridors. Creating more density, mixed-use development, and a critical mass of housing and commerce within the downtown core and the corridors is a sustainable alternative to unrestrained periphery and green field development. Fourth, there is significant redevelopment potential within the study area, of a scale that is not intuitively apparent. The studio determined that there is a potential scope to the redevelopment of the study area of 4.1 million square feet, which does not include downtown core itself. The projected cost in 2006 dollars for these improvements is \$1.0 - 1.4 billion.

3. LEED – ND EXPERIENCES INFLUENCE PRELIMINARY DESIGN DECISION MAKING

Taking the point overview from LEED – ND, the students analyzed the areas that showed most promise for their particular context and site situation. Many of the titles and descriptions in the point overview document were familiar to the students, but many were new. In this way, LEED – ND introduced students to both individual areas of consideration, but more importantly, helped students see patterns and intensities of impact. For instance, locating a new project on a previously developed or infill site yields a significant percentage of points (up to 10 points). This confirmed to the students that there is great value in building on previously developed sites, primarily because of their level of connectedness. Students developed their point overviews to optimize site opportunities (Table 2).

Table 2: A Partial LEED – ND point overview. Source: (Stewart 2006)

LEED – ND POINT OVERVIEW		
Title	Description	Points
Location Efficiency		
<i>Prerequisite:</i> Transportation Efficiency	Locate the project on either an infill site or on a previously developed site	N/A
<i>Prerequisite:</i> Water and Storm water Infrastructure	Locate the project on a site served by existing water and sewer infrastructure replacement or other on-location improvements to existing infrastructure are considered "existing" for the purpose of achieving this compliance path.	N/A
<i>Credit:</i> Adjacent, Infill, or Redevelopment Site	Locate project on a previously developed site.	8
<i>Credit:</i> Reduced Automobile Dependence	Encourage development in locations that exhibit superior performance in providing transportation choices or otherwise reducing motor vehicle use.	2
<i>Credit:</i> Contribution to Jobs-Housing Balance	Encourage balanced communities with a diversity of uses and employment opportunities. Reduce energy consumption and pollution from motor vehicles by providing opportunities for shorter vehicle trips and/or use of alternative modes of transportation.	4
<i>Credit:</i> School Proximity	Promote public health through physical activity by facilitating walking to school. Promote community interaction and engagement.	1
<i>Credit:</i> Access to Public Space	Locate and/or design project so that a public space such as a park, plaza, town square, village green, etc., lies within 1/2 mile of the all the entrances to the project's residential and commercial buildings.	2

This student chose to develop neighborhood density just south of the downtown core, and placed the art museum at the intersection of Route 31, the north-south street, and Walnut Street, the east-west street. These local sites were previously developed but vacant and dilapidated. She subdivided the large architectural program into a “community” of buildings rather than a single structure. This allowed her the ability to maintain a massing scale consistent with the surrounding fabric and also spread the uses out among multiple sites (Figure 5). The massing strategies yielded a building on the north and south side of Walnut Street; and a third building mass on the east side of Route 31.

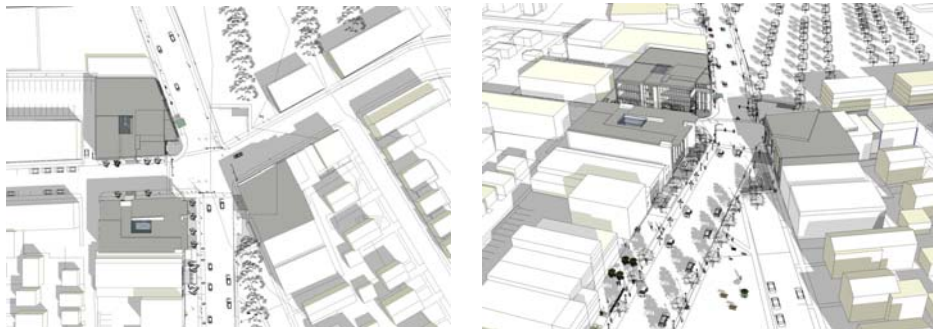


Figure 5: Redevelopment area at Route 31 and Walnut Street. Source: (Stewart 2006)

4. HIGH PERFORMANCE BUILDING FAÇADE PRECEDENT STUDY

Following the investigations at the neighborhood scale, the students developed an architectural program for the community art museum building type within their study area. The programmatic work concluded with a precedent study for high performance building façade that the student deemed appropriate given their site and orientation. One significant factor in the selection of precedents was a programmatic requirement that stipulated that the museum employ literal and/or phenomenological transparency. This requirement was a function of the idea that community art museums are public in nature and one means by which public-ness can be conveyed is by demonstrating material transparency. In addition, the students were advised to investigate building façades which operated as “integrated” systems (Lee 2002).

The previously mentioned student researched a number of buildings which included material transparency, day lighting and ventilating façade strategies. She documented and developed digital section models of the Bayer new Group headquarters, by Architect Helmut Jahn, including a north and south building façade based upon published design documents. She conveyed conceptual understanding of the building technology in a variety of ways. First, she demonstrated the understanding that different solar orientations require different applications of technology. The north façade and south façade are handled differently in this particular application and she purposefully modeled those differences. Secondly, she demonstrated an ability to effectively visualize and communicate differences by comparing and contrasting the two building façades (Figures 6 and 7).

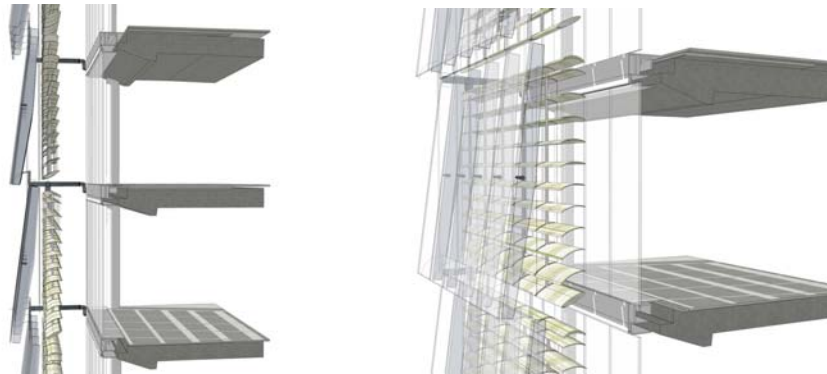


Figure 6: Digital Representation after Bayer new Group headquarters, north façade, Architect Helmut Jahn. Source: (Stewart 2006)



Figure 7: Digital Representation after Bayer new Group headquarters, south façade, Architect Helmut Jahn. Source: (Stewart 2006)

5. IMPACTS ON PRELIMINARY DESIGN

The impact of the precedent study on the example student's work is revealing. Because of siting choices, the northern building has a south façade along Walnut Street and the southern building has a north façade along Walnut Street (Figure 8). The student chose two different types of glazing systems for the façades along Walnut Street, demonstrating an understanding of the different solar orientations of the façades. The student also included operable louvers on the south facing elevation to further control summer heat gains and allow passive

solar in the winter. These combine to demonstrate the multiple layers of sustainable approaches early in the design process.

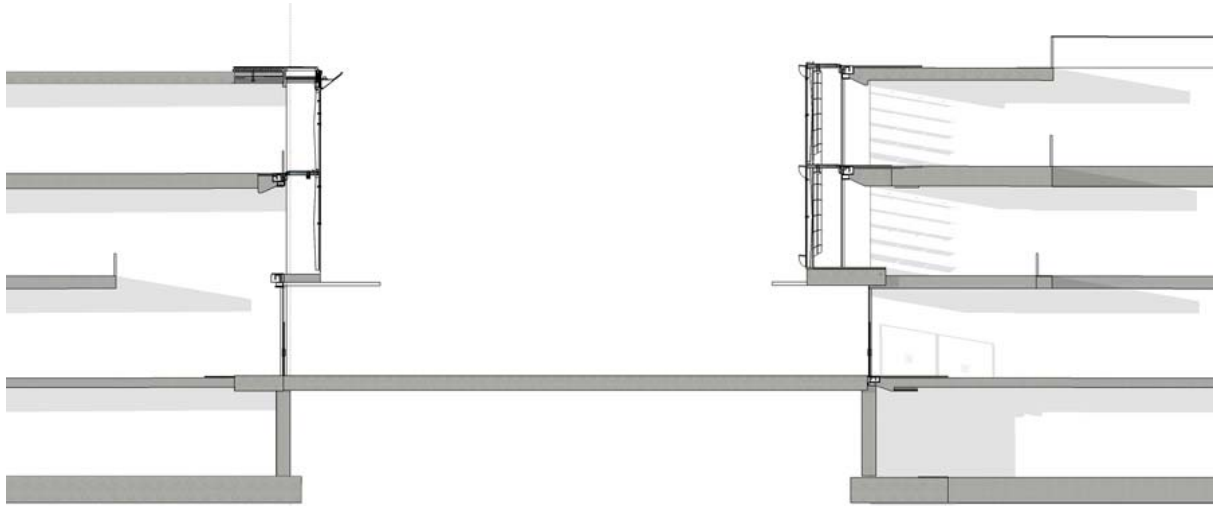


Figure 8: Elgin Community Art Center, schematic design section at Walnut Street. Source: (Stewart 2006)

CONCLUSION

The outcome of this approach was varied. Both the experience of applying LEED – ND criteria to a particular site within the *Four Entry Corridors Study* area and the research and documentation of a precedent high performance building façade yielded important formative student work. For the most part, students were able to negotiate the neighborhood scale following strategies derived from LEED – ND and they were able to understand the importance of connecting to existing infrastructure, transit, circulation, and working within existing site efficiencies. They developed a confidence in working with LEED. The students were enthusiastic about generating digital models of high performance building façades. They carefully chose relevant precedents with regard to solar orientation and building materials. On the other hand, value tensions at times arose because of the predictable struggles between design intent or programmatic need and environmental strategies. Reconciling those tensions in the massing and preliminary design stages of development was a difficult task for most students because of the leanness of their experience with sustainable approaches, yet most of the students remained enthusiastic about doing so. The design pedagogy was successful at energizing the students in this particular course and helped generate interest in sustainable design.

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