ISSUES OF HEALTH IN ARCHTECTURAL EDUCATION: COMPLEXITY, INTERDISCIPLINARITY, AND FRAMEWORKS

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ABSTRACT: Increasing interest is seen at the intersection of architecture and health. The built environment has become associated with health outcomes including obesity, cancers, and diabetes (Sallis, J. F., et al. 2012). Engaging our students in these inquiries surrounding health is important in preparing them for future practice, regardless of the specific building type on which they ultimately focus. This paper reviews the implementation of one such course focusing on the well-being and overall health of the occupant, using the frameworks of the WELL Building Standard and the Living Building Challenge (LBC). The reviewed course engages interdisciplinary teams composed of students from the School of Architecture, the College of Engineering, and the College of Natural Resources, with private practice. Through these partnerships, students focus on real-world projects as case studies to conceptually assess health and well-being implementation strategies, lending prominence to wider sociocultural influences surrounding the topic of health in the built environment (Kahu 2013). The course, rooted in the theoretical perspective of Constructionism, puts forth an effort to break out of the conventional assumptions and meanings commonly associated with an object (Crotty 1998), such as the built environment's neutral impact on health. The course has been specifically designed to: (1) establish a framework for common content relating to health in the built environment across disciplinary boundaries; (2) build meaningful partnerships between a variety of student focus areas through intentional exercises; and (3) establish a common vocabulary between architectural education and aligned disciplines regarding health and the built environment. The course structure, activities, and assessments are reviewed, proposing a solid template for including integrated design and themes of health in architectural education, and providing methods for sharing the value of the architectural education process across campus.

KEYWORDS: health and well-being; built environment; interdisciplinary; sustainability; course development

INTRODUCTION

While the conversation around sustainability and green building still includes a heavy emphasis on energy use, resource consumption, and material selection, there is an increasingly strong thread of discussions swelling around the health and well-being of building users. Though this topic is not new, the vitality around it is growing, and quickly (Vanette 2016; Brammer 2016; Alter 2016; Welker 2016). Contemporary health issues abound, including concerns with sedentary activity (Chae, Kim, Park & Hwang 2015; Jackson, Lewis, Conner, Lawton & McEachan 2014), obesity (Barkin, Heerman, Warren, et al. 2010; Finkelstein 2010; Kowlessar 2011), nutrition (Kahn-Marshall & Gallant 2012), and mental health (Addley, et al. 2014; Wang, et al. 2014). Literature at the intersection of health and the built environment primarily focuses on associations between the built environment and health behaviors and/or outcomes, largely at the planning scale (Frank & Engelke 2001; Frumkin, Frank & Jackson 2004; Koohsari, Karakiewicz & Kaczynski 2013; Besenyi, et al. 2014). Little literature addresses how to begin to incorporate these complex themes into architectural education. Issues of health and the built environment can and should be addressed in the design of all of our spaces, and should therefore be addressed somewhere in our design curriculum. This article describes the development of such a course, which has been hosted twice with equal success. The course is listed as a seminar course, but functions more as an inquiry-based lab, designed around the formation of interdisciplinary groups and engagement with architectural practice to address these complex issues.

1.0 BACKGROUND

Building owners are increasingly interested in the health and well-being of their employees (Horwitz, Kelly & DiNardo 2013). Though this is a fairly simple statement, there issues of complexity buried in the concept of well-being including both mind and body considerations. These issues far exceed the scope of an architect's expertise, but should not land outside the professional architect's sphere of influence. The increasing popularity of systems such as the WELL Building Standard and FitWel indicate the growing importance of health concerns in the built environment. Leading firms such as Perkins + Will (perkinswill.com/purpose/wellness) are adopting these issues as priorities in their design processes. Given this interest, these multifaceted topics should be addressed somewhere in architectural education to better prepare students for future practice. Because of the complexity inherent in the topic, interdisciplinary groups should be addressing these challenges, puncturing holes in disciplinary boundaries.

This study focuses on the two-time execution of a seminar course, hosted out of the School of Architecture at North Carolina State University, addressing the review and assessment of health and wellness in the built environment. The questions reflect on the implementation of the course, without research intent during the design of the course. As such, the primary research interest of this paper is to establish a better understanding of how health and wellness considerations can be incorporated into architectural education outside of the studio setting by critically assessing the success of the course.

2.0 RESEARCH AND COURSE GOALS

Because of the specific focus on including standards relating to wellness, and availability of the course information, this review is structured methodologically as a case study rooted in a constructionist epistemology. As noted by Crotty, "[Constructionism] is the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context." (1998) This way of knowing translates into the case study methodology. Case study research promotes an in-depth understanding of a single or small number of "cases" set in real-world contexts (Bromley 1986; Yin 2015), embracing socially constructed knowledge. It is important to study specific cases in depth focusing on the questions of *How* and *Why*. Yin has argued that a case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context" focusing on questions framed in How and Why (Yin 2015). Groat and Wang (2015) suggest that case studies can be used to "explain causal links."(Yin 2015) Similarly, Yin believes that case studies can "explain the presumed causal links in real life interventions that are too complex for the survey or experimental strategies." This article seeks to explore possible causal links between elements of the designed course and course outcomes.

2.1. Establishing a Supportive Course Structure

The seminar course has been held twice in subsequent spring semesters, structured in a three-hour timeframe meeting once per week. Twenty-seven students participated the first time the course was held, and thirty enrolled in the second offering. The distribution of students can be seen in Figure 1.

	2016	2017
Undergraduate	13	11
Graduate	14	19
Architecture	19	17
Engineering	2	7
Env Sciences	6	6
Total Students	**27**	**30**

Figure 1

Both years, this distribution allowed at least one student in each of six groups to provide perspective and expertise from outside of the design field. In the second year, the number of engineers increased, allowing the ratio other fields to architects to increase, with at least one student from Natural Resources and one from Civil Engineering in each group. This shift in student population initially indicates a growing interest in these areas outside the architecture field, though additional semesters would be needed to confirm this trend.

The course is divided into three modules across the sixteen weeks of the semester. During the first module, content is shared by the instructor to provide a foundation of knowledge about the state of green building in the built environment professions. While many of the students are familiar with the concept of the LEED Rating System, few have had courses on it or have been involved in a LEED project directly. Because this course is not focusing on LEED as a strategy or an end goal, the review of the system is basic. However, it is included, understanding that the system is the current and most accepted measuring stick for green building in the design and construction industries. A member of USGBC leadership has participated in both years to discuss the origins and evolution of the LEED Rating System, including thoughts on how the two systems that the course will focus on (WELL and LBC) compare and contrast with LEED. Representatives from the WELL Building Standard and the Living Building Challenge have also been brought in, both in person and remotely, to share the larger goals and approaches of the two systems. At the end of this first module in the course, the students begin to compare and contrast the systems, using case studies of award-winning green buildings for conceptual, basic assessments.

The second module of the course focuses on digging deeply into the different categories of the two systems, WELL and LBC. This allows the students to understand particular strategies as well as required thresholds and measurements to work toward achieving certification in the two systems. The students are arranged into interdisciplinary groups and are tasked with researching and presenting one or two of the systems categories, or petals, and their requirements.

For example, with the differing perspectives in the teams from interdisciplinary team members, a more holistic representation of the issues are provided to the class to help deepen their understanding of opportunities and challenges.

Also during the second module, we strive to engage industry experts. For example, during the class session dedicated to Energy, the assigned student group is tasked with giving their presentation for the first half of class, with the same expectations and timeframe as the other groups. Then, during the second half of the class period, an engineering firm that specializes in net-zero design comes in for a presentation and discussion about their strategies, opportunities and challenges in the real-world context. Similarly, for the class dedicated to Materials, the group gives their presentation for one half of the class, while a local expert with Cradle-to-Cradle shares insight on processes and considerations in material selection. These guest speakers, along with the detailed presentations on the topics and credits from the two systems, provide all students with more in-depth information that will serve them well for the rest of the semester. By the end of the second module, the students have at least a basic understanding of the different considerations and possible strategies to achieve credits through each of the rating systems, from various perspectives.

The third module of the semester focuses on the conceptual application of the two systems to real-world projects. The students remain in their interdisciplinary groups from the second module, each partnered with a local firm to explore a project in process. Over the duration of six weeks, the student teams meet with firms twice: once for an initial brief of the project, and once for a follow up consultation to address specific questions pertaining to certain credits in the two systems. The final deliverable for the semester is a public presentation about the feasibility of each project to achieve some type of WELL or LBC certification. Throughout third module, students are charged with assessing the inclusion of specific strategies in their projects, looking conceptually at challenges and opportunities with the design and operations of the facility in question. Issues including air filtration, urban agriculture, occupant fitness, and material content are only some of the complex issues addressed by the student teams.

The goal of this phased course structure was threefold. First, establish a foundation of knowledge that the students across disciplines could appreciate and understand. Second, empower interdisciplinary partnerships to build upon that knowledge. And third, apply this new knowledge to a real-world project from a variety of interdisciplinary perspectives. These goals were achieved in great part due to the scaffolding of the information and partnership development across the phased semester.

2.2. Interdisciplinary Engagement

Because of the complexity of health issues in the built environment, one of the primary goals of the course is to engage the students meaningfully in interdisciplinary activities and partnerships, supported by the previously reviewed structure. Education of sustainability themes should be viewed as an exchange acknowledging multiple viewpoints and differing perspectives to be both voiced and validated within the classroom (Coops, et al., 2015). Within this dialogical environment, the intention is that the open learning environment itself promotes meaningful interaction, partnerships and "positive appreciation of diversity."(Coops, et al., 2015; Misanchuk, Schwier & Boling, 2000). This was the overarching goal of a group arrangement for the students.

While architecture practice is rooted in collaborations and interactions with professionals from other disciplines, there is rarely an opportunity for students to participate in these types of meaningful activities during their university education. In design education, as well as in Engineering and Natural Resources, most of the required classes and disciplinary electives are insular. Many of the electives outside of the majors are either large classes in lecture format that offer no opportunity for interaction, or are seminar classes that can facilitate potentially valuable discussions, but do not include interactive group work. The phased modules and group structure was designed to address this.

To ensure interdisciplinary teams, students were grouped in their home departments, and then numbered off into groups of six. This method resulted in evenly distributed expertise for each group, though the majority of group members has been from architecture both semesters, given the overall distribution of the disciplines in the class. Observations of team work during class periods showed that most teams worked well together and were eager for input and insight from other fields.

2.3. Engagement of Practice

Another primary goal for the class is to apply the newly formed knowledge in a real-world project. This structured collaboration with professional practice allows for an element of service learning in the class and, in most cases, flips the role of expert from the practitioner to the student. Thus far, the practitioners are not well-versed in either the WELL or LBC systems, allowing the student groups the opportunity to share knowledge of the system and bring enrichment to the profession.

Student groups were assigned randomly to partner firms as the class moved into the final module. Firm profiles were

printed and put into blank envelopes and student groups each picked one to determine their partner and project. One student was assigned to be in charge of communication with the firms so as not to overwhelm the contacts with numerous emails and queries. Both students and professionals expressed value in this interaction. Students were excited to participate in a real-world design project, many not having internship with a design firm experience prior to the course. In addition to getting exposure to a new perspective of the built environment, the students felt that this project could be an element of their portfolio, providing a notable distinction between their application package and other job seekers. Lastly, students valued the personal relationships developed with practicing professionals at the different firms. Professionals agreeing to participate were eager to engage students, and happy to discuss opportunities for design strategies with the teams, as well as entertain larger questions about the profession, providing valuable insight for future practitioners. Similarly, the owners that were directly engaged were also exceptionally interested, and happy to request engagement in the course from their project teams.

3.0. ASSESSMENT

There are a number of ways to begin to assess the success of the course in reference to the stated goals, through different perspectives. Perspectives of the course could be offered from the students themselves addressing: (1) the perceived shift in their knowledge across the duration of the course; (2) the success of the interdisciplinary teams; and (3) their overall opinion of the value of the course itself. Assessments could also come from the practice partners, providing insight on the process, engagement of students, and deliverables and insights provided. And lastly, the goals of the course could be addressed by both observation and through reflection on each of these other feedback methods. Each of these techniques were addressed in both semesters.

3.1. Pre- and Post-tests

Assessment of the course goals is primarily based on self-reported pre-test and post-test data. The initial goal of the pre-test and post-test was to better understand the perceived level of knowledge gained during the course. The pre-test is given on the first day of class, immediately after review of the syllabus and expectations for the course. The post-test is given on the very last day of class, after all content has been reviewed and all presentations have been given. The statements were provided with a Likert scale from 1-10, addressing different measures of knowledge about health and the environment. The statements covered perceived understanding of strategies, thresholds and resources. Directions were, *Please rate your perceived current level of knowledge in each of the following on a scale from 1 to 10. Statements included: How buildings impact human health*; *Rating systems available beyond LEED to measure the impacts of the built environment*; *Possibilities for a design project to have a positive environmental impact on a community*; *and Leveraging interdisciplinary partners to address project challenges and opportunities.* No names were provided on the sheets, ensuring anonymity of respondents. The self-assessments were collected at the end of each class, students delivering the individual papers or small groups of papers to the instructor.

As shown below in Figure 2, the pre-test and post-tests from both semesters indicate that the students believe there to be significant growth in understanding between the beginning of the semester and the conclusion of the course, as well as in the appreciation of interdisciplinary perspectives. Total completions of the survey are noted.

Spring 2016 Pre-Tests (27 completions)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
4.10	3.45	5.07	5.55	4.00	4.17	5.03	4.62	5.97	3.97	5.86

Spring 2016 Post-Test (22 completions)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
8.00	8.59	7.86	8.45	8.05	7.36	8.36	7.00	8.32	7.59	8.86

Spring 2017 Pre-Test (26 completions)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
5.19	4.68	5.50	6.12	4.92	4.92	5.81	4.85	5.62	4.54	6.31

Spring 2017 Post-Test (27 completions)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
8.11	8.59	8.11	8.56	8.11	7.70	8.37	7.81	8.37	7.81	8.89

Figure 2

3.2. Course Goals

A second way to assess the course is to reflect on the course goals. The course has been successful in the three overarching goals of: (1) establishing a framework for common content relating to health in the built environment across disciplinary boundaries; (2) engaging students in meaningful interdisciplinary experiences; and (3) establishing a

common vocabulary for discussion of these topics between student disciplines. A discussion of each follows.

Goal 1: Establish a framework for common content relating to health in the built environment across disciplinary boundaries. In an effort to create common knowledge between students from different disciplines, the course uses two established assessment frameworks as a way to structure complex topics across expertise: the WELL Building Standard and the Living Building Challenge (LBC). The decision to use established frameworks was based on the success of a similarly formatted course at North Carolina State University, hosted by the same faculty member, structured around the LEED rating system for Building Operations and Maintenance. The two courses (LEED and WELL/LBC) both have the primary goal of engaging interdisciplinary teams and facilitating meaningful group work. The use of established frameworks facilitated unbiased conversations among group members, not catering to one field over another. Students were happy to engage these systems, and discuss their goals and strategies through different discipline perspectives.

Similarly, while not all students had previously participated in a real-world design process prior to the course, they were all excited at the prospect of collaborating with a firm. The involvement of practicing professionals seemed to heighten the quality of deliverables. Likewise, firms that participated in the first semester of the course proactively asked to be able to participate in the second semester.

Goal 2: Build meaningful interdisciplinary partnerships through intentional exercises. Exercises given to the class throughout the semester were all interdisciplinary and targeted at increasing understanding across discipline boundaries. Strategically designed exercises included case studies where different discipline perspectives were articulated, and conceptual assessments of the two systems were reviewed in class. Other examples include a Myths and Stereotypes exercise where students were sectioned into college groups and asked to identify three myths and stereotypes about each group, including themselves. Upon the out-loud sharing of obviously ridiculous statements such as, "Engineers all play World of Warcraft," "College of Natural Resources students all study grass or something," and "Design students never shower," the groups became much more comfortable around each other and the class became something of a safe space; no judgment would be helpful or tolerated. These new partnerships were strengthened through the group work.

Goal 3: Establish a common vocabulary between architectural education and aligned disciplines regarding health and the built environment. Collaborative, interdisciplinary presentations during the second module of the course helped to position specific topics of interest and possible strategies in a common framework for the entire class. This interdisciplinary approach enables students from different backgrounds to see the value of a concept from other perspectives. The resulting multifaceted understanding helps to enrich every student's appreciation of the goals and approaches for different strategies and thresholds in the systems, providing a better understanding of possibilities and realistic options for strategies.

4.0. OPPORTUNITIES

There are many opportunities for improvement and modification in the course as it matures. The most significant areas for improvement revolve around project selection by the firms, and increased participation across disciplines.

4.1. Project Selection

Over the course of two semesters, one opportunity consistently found to enrich the conceptual assessment of real-world projects would be to create criteria for both project types and phases of projects. Because it is necessary that we have six firms participating, with one team for each project, the instructor simply asked for participation from local firms without giving criteria for project selection. Most firms approached were happy to participate, though one was unable to participate at the last minute in the first iteration because there was a problem with the project they had in mind. The projects selected for the first semester were across the board and included a sorority house; a primary school; a guard house for a laboratory facility; a higher education classroom building; a large biotech facility; and a new city market.

In the second semester, owners were approached in addition to design firms, targeting two local school systems and the home university. The design firms that were approached were eager to participate and brought forth the following projects: a university lab building; university classroom and research building; and a new wing addition to a local hospital. The owners that were approached were even more excited to join and brought forward their own undertakings, as well as engaged their associated design teams. The larger local school system was interested in exploring a prototype that had been operating for a year in one location, and is scheduled to be rebuilt in the few next years. The smaller local school system, who is a leader in sustainability themes in both facilities management and integrating education, wanted to look at a major renovation of their high school. The university, who served at the third client, was interested in looking at the major renovation and construction of the student recreation and wellness center. Each of the projects identified by the firms and owners alike provided a rich context for student engagement.

The results of the different approaches to real-world engagement across the two semesters indicates that it may be better to seek to engage owners, particularly those interested and invested in the population health of their buildings, such as K-12 and the university student population.

4.2. Increased Participation
While it could be argued that the basics are covered with the mix of students currently in the class, including architecture, civil engineering and environmental sciences, the interdisciplinary interactions could be enriched by having additional perspectives in the class. Disciplines such as Landscape Architecture, Psychology, Policy, and Mechanical Engineering are only a few that would lend valuable insight to assessing the opportunities for these rating systems. It will take considerable effort to begin to engage these populations, but one they are involved, as with Civil Engineering, it is anticipated that there is a swell in significant interest and class enrolment.

5.0. DISCUSSION

This analysis indicates that the course achieves success in each of its primary goals. The use of established frameworks has shown to be a valid tool for integrating different disciplines meaningfully toward a common understanding of a complex issue. Exercises given to the class helped to establish meaningful partnerships between disciplines, fostering relationships and trust between allied fields. The three-phase structure and delivery of the course helped to establish a sense of community among the participating students. Overall, peer reviews of team members were overwhelmingly positive, despite notations of different strengths and traditional ways of processing information.

Common presentations, reviews of content, and engagement in a somewhat standardized design process with design firms help to establish common vocabularies around concepts in the intersection of health and the built environment. By engaging established frameworks that address different disciplines equally, while simultaneously positioning students in interdisciplinary teams, complex issues of health and sustainability in the built environment can be successfully incorporated into design education.

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