Design-Build as a Reversal of Professional Practice

In this paper, we discuss an academic Design-Build project in terms of parallels which exist between the project and professional practices of design-then-build. We establish that the academic Design-Build studio and professional practice create their respective identities in how they deal with common concerns such as limited time, budget and material resources and issues of liability in the design process.

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Yet, differences between academic Design-Build and professional practices exist. We argue here that Design-Build is not a small version of professional practice, but is in some respects its reversal or counterpoint.

In their paper "Building a Social Framework," Chad Schwartz, Laura Morthland and Shannon McDonald seek to develop a response to the following question: "If architectural pedagogy lacks a focus on the critical social awareness that is a necessary component of professional practice, how then are young architects-in-training introduced to these social facets?"[1] The authors argue that "academic service-learning" (i. e., Design-Build) provides a unique combination of technical and social experiences. Citing Dana Cuff, who argues that "school disembodies the primary professional activity of design from its context,"[2] the authors frame the project documented in their paper as an attempt to "reconnect" a design process to a larger economic and social context, with "significant interaction with professional partners" (e. g., engineers). Here, we describe an academic Design-Build project which shares these motivations and aspirations but which took a unique approach to meeting pedagogical goals. We conclude by asking whether professional practice could benefit from selective adaptation of tactics from Design-Build in general, and our project in particular.

ACADEMIC CONTEXT

The project which is the subject of this paper was structured as a graduate-level elective studio and seminar incorporated in the professional M. Arch degree program at North Dakota State University in Fargo, North Dakota. The project had its inception in 2010, when the Minnesota Pollution Control Agency invited author Srivastava to demonstrate the Passive House concept through the construction of a full-scale demonstration project at the 2011 Minnesota State Fair Eco-Experience exhibit. This opportunity became the nucleus of NDSU's inaugural Design-Build program (hereinafter NDSU D/B) planned and led by Srivastava. In 2011, NDSU D/B designed, constructed and exhibited a four-person, 650-net-square-foot cabin at

the Minnesota State Fair. The cabin was pre-certified by Passive House Institute US, and was ultimately visited and viewed by over 250,000 people.[3] (Author Atwood was one of the students leads for the duration of the studio. Author Christenson served as a faculty critic and Principal Investigator for an internal grant supporting NDSU D/B.)

Academic Service Learning. Typically, service-learning as it relates to academic Design-Build programs carries the association of leveraging university resources to benefit both students as well as communities, in particular, underserved or distressed communities. An example of this typical form of service-learning is the well-known Rural Studio at Auburn University.[4] In general, such projects seek to provide a community with a tangible, built asset in the form of one or more permanent structures for use by community residents.

Vincent Canizaro argues that the "intention to provide service to local communities" is an important motivation or characteristic of academic Design-Build programs in general.[5] Significantly, Canizaro points out that academic Design-Build programs assume a pragmatic approach in that they are capable of taking on projects which would be of little or no interest to professionals because the projects have little or no potential for profit. Furthermore, some programs pursue a form of community service out of a "commitment to social justice," the primary example of which, again, is Auburn's Rural Studio. Other examples of academic Design-Build programs committed to social justice include the University of Oregon's Design Bridge program and Miami University's Center for Community Engagement.[6]

NDSU D/B constituted yet another distinct approach to service learning. Invited by the Minnesota Pollution Control Agency to demonstrate high-end energy-efficiency practices, NDSU D/B students participated in the design, research, analysis and construction of a full-scale demonstration house exhibited in a public forum – the Minnesota State Fair. Students staffed the exhibit for 12 hours daily in shifts, answering questions and providing information and demonstrations to fair visitors -- including many people with little knowledge of energy efficiency, but also several energy-efficiency enthusiasts and specialists. The students gave public presentations on a topic of their choosing rooted in their research, design, and investigations conducted prior to the exhibit. The primary purpose of NDSU D/B was to provide education to large numbers of community members, in this case 250,000+ visitors over a period of ten days.

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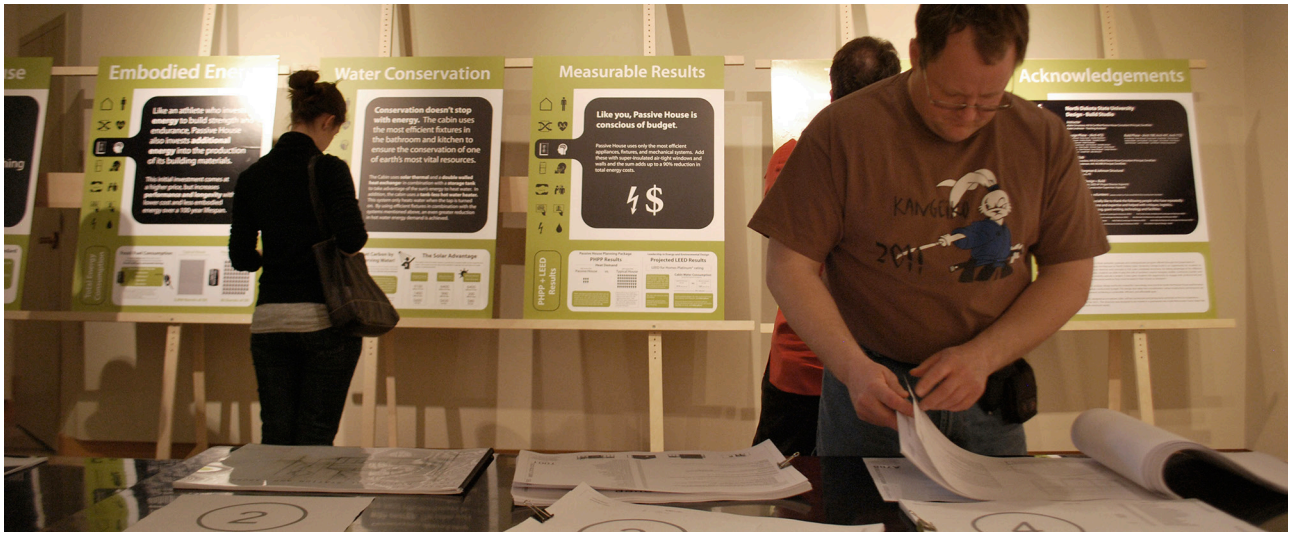

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Jason Pearson has written of "University-community design partnerships" (i. e., Design-Build programs) that "[b]y engaging students and faculty in the design and construction of actual built projects, these partnerships meet dual educational objectives, simultaneously educating students in the realities of public service and educating communities about the value of design in achieving a positive future."[7] NDSU D/B provided a form of service learning which, while serving to "educate [a community] about the value of design," did so without providing a permanent, in-place asset for the community. In the case of NDSU D/B, service learning resulted from the educational exhibit for community benefit. This community education component is distinct from, though related to, the education provided to the students in how to explain their processes, the design, and the products used in the demonstration exhibit.

Construction Experience. Canizaro argues that the idea of giving students direct exposure to, or involvement with, construction is "common to all" academic Design-Build programs and is in fact the primary motivation for some programs. He cites examples including the Yale Building Project and Southern Polytechnic's Construction Workshop. Canizaro argues that the academic focus on construction is argued as "a necessary exposure for future professionals."[8] While NDSU D/B provided substantial construction experience to students, doing so was not the program's primary motivation. Over the course of the project, NDSU D/B students considered a range of different project options and sites, resulting in a collective understanding of the application of various construction methods within the context of place, use, and building performance and type. The project did not begin with an assumption of which construction method or system would be ideal. Eventually the decision on how to proceed was based on experiments with full-scale assemblies of various wall section designs, understanding the impact of the formal and spatial design on performance, quantifying the performance through energy-modeling tools, and the availability of material donated to the program. For example, the NDSU D/B program was unable to procure a material donation to support its preferred envelope construction (SIPs), but earlier experiments and tests made it possible for the students to adopt instead a double-stud construction.

To be involved in the entire process from ideation to construction allows an understanding of how design-decision making translates to built construct is of much greater value. Students were forced to adapt details that had been easy to draw or model (digitally or physically) but were not feasible at the full scale due to limitations

Figure 1: NDSU D/B student explaining educational exhibit to Minnesota State Fair visitors. (Photo: Mike Christenson.)

Figure 2: Educational exhibit constructed by NDSU D/B students. (Photo: Drew Jacot.)

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Figure 3: NDSU D/B students raising the wall into place. (Photo: Peter Atwood.)

of resources or limitations of skills or the fact that different tools have different tolerances and the fine tolerances of one tool (such as a sharp lead pencil or the digital straight line) do not always translate to the tolerances of another tool such as a chopsaw or planer or the idiosyncracies of each material. Bringing their ideas full circle allowed the NDSU D/B students to understand construction not just as a series of representations but through engagement with actual materials. Moreover, student knowledge was not just rooted in a certain construction method but was enriched by an understanding of how this method applied to a specific context factors such as climate, site, form, method, enclosure design, and ease, craft, speed and tolerances of construction. For these reasons, NDSU D/B differed from Design-Build programs that collaborate with programs like Habitat for Humanity or Freedom by Design to give their students construction experience. It also differed from programs that pass on the designs done by students in consultation with professional architects and engineers to professional builders to give their students the experience of a professional practice. Some students participated only in NDSU D/B's first semester (the "Design" semester) and others participated only in the program's second semester (the "Build" semester). However, there were a handful of students who participated in the entire program and experienced the full pedagogical intent of translation of idea to construct.

Scale. Comparing Design-Build to any other pedagogy otherwise experienced by the students, the scale of the academic Design-Build project is of an order of magnitude greater. In general, this scale-shift applies to the scale of time, project size, the number of collaborators, finances, educational outreach, community impact, and complexity of the project. The interrelated concepts of "presentation" and

"feedback" provide an example. Instead of the typical project critique at the conclusion of a project where suggestions for improvement or an evaluation of the success or failure of the project are given, in NDSU D/B feedback was given in order to contextualize design decisions in the larger context of the project. This feedback was not given at a final critique but rather regularly through the project. In place of a typical academic presentation of a model and drawings, NDSU D/B's presentation consisted of ten days' worth of public interaction and education.

Throughout the design, construction, and exhibition processes, the NDSU D/B students received feedback on their work not only from their instructor but also from project sponsors and consultants. Moreover, feedback was not simply in the form of "suggestions," but students were required to act on the feedback received. Students not only reacted to feedback but also learned to proactively engage the act of design dialogue. Throughout the project students understood that the implications of their design decisions were of a much larger scale than they were accustomed to.

Although the NDSU D/B project resulted in a full-scale, inhabitable construct, the design and construction processes also addressed other aspects of full-scale pedagogy, including experimental full-scale investigations, in which students tested assemblies for their ability to drive higher-level decisions; prototypical full-scale investigations, dedicated to the instruction of particular techniques; and generative full-scale investigations, operating as a source of ideas and inspiration.[9]

PARALLELS, REVERSALS, AND DEPARTURES BETWEEN NDSU D/B AND PROFESSIONAL PRACTICE

Time Pressures. Professional practice and academic Design-Build projects are similarly constrained by schedules such as construction deadlines. However, academic Design-Build programs are additionally constrained by academic schedules which cannot reasonably be expected to coordinate smoothly with construction schedules. For example, typical design studios come to a conclusion at the end of the academic semester, while Design-Build studios may need to span two or more semesters, requiring academic programs to deal with attrition and the question of student commitment to a project over multiple semesters. This differs from the conditions in place in professional practice: while project staff may vary over time, there is in general a level of personnel consistency among the core staff. In NDSU D/B, no formal commitment was required of the students transitioning between "Design" and "Build" semesters, resulting in limited attrition as well as mid-project enrollment of new students. Yet, as mentioned above, a core group of students voluntarily remained committed to seeing the project through.

NDSU D/B was constituted as a six-credit studio. Several aspects of the project could legitimately have constituted independent seminars outside of the studio, including the work of teaching and learning about Building Science and energy modeling; the exploration of building materials through vendor presentations, research and full scale investigation; construction methods; preparing construction documents including specifications and construction drawings; and entrepreneurial funding methods. Had NDSU D/B been limited to a single semester, or had some of the "seminar" topics been excluded, NDSU D/B could possibly have achieved similar results, but at the cost of deep investigation of issues. The six credit hours assigned to NDSU D/B were inadequate for the students to complete the required tasks, with the result that much of the work was accomplished outside of official class time. Like professional practice, NDSU D/B can be said to be subject to what Cuff has called the "charrette ethos": i. e., the willingness of staff or participants to work overtime to produce quality work.[10] Unlike professional practice, many of these hours can be

attributed to students engaging aspects of the design, documentation and construction process for the first time as opposed to depending on a level of experience that is assumed on the part of a professional design team.

Limitations on Budget, Materials, and Labor. In professional practice and construction, labor costs are at a premium, while in the typical academic Design-Build project the opposite is true. The typical Design-Build project in the context of a professional architectural curriculum incorporates several hundred person-hours from craft-oriented, innovative students, most or all of whom are highly motivated to pursue a design process where analysis, creation, ideation, discussions and decisions occur through the making of at-scale and full-scale representational artifacts, followed by a construction process which is not only highly detail-oriented but is overseen and/or carried out by many of the same individuals involved in design. NDSU D/B was no exception to this general rule.

Project Goals as Constraints. The educational component of NDSU D/B, as is the case with many academic Design-Build projects, lent the project a level of inefficiency which would not be tolerated in a professional context. In NDSU D/B, this inefficiency derived largely from the need to educate the students about architectural projects beyond the schematic design phase. For example, the pedagogical imperative to engage in full-scale construction as a testing and learning methodology during the design semester slowed the process.

As has already been discussed, academic Design-Build projects often differ from professional projects insofar as they address the needs of underserved communities, i. e., they provide a form of assistance not readily available to these communities. In the case of NDSU D/B, while the motivating goal was to build the demonstration house, the underlying goal was community education, wherein the students became teachers based on their educational experience.

In the second planned iteration of NDSU D/B, which did not materialize due to administrative difficulties, the goal was to educate the local construction community in the details of a newly adopted energy code. The City of Fargo and the NDSU D/B organizers shared the goal of educating the construction/builder community about the new code; as before, the students would have worked as educators. Had this second iteration of NDSU D/B materialized as planned, the program would have resulted in a permanent built structure, differentiating it from the first iteration which required the disassembly of the demonstration house and transport to a permanent site.

Differences in Engaged Communities, Responsibilities, and Assessed Risk. Every construction project engages a diverse community of actors including clients, contractors, municipal agencies, and so on. Traditionally, in a professional project, members of this diverse community are predisposed to enter into adversarial relationships – every party to an agreement carries their own insurance against risk. One party or entity is responsible for the project's architectural design, another entity is (or several entities are) responsible for providing engineering services, yet another party is responsible for executing instructions to build the project, and an entirely distinct party (the owner) is responsible for paying for the project. The "project community" changes for each project, and even throughout a single project different members of the project community are present at different levels of involvement.

The NDSU D/B process assumed a structure with respect to risk more akin to the contemporary model of Integrated Project Delivery (IPD). While the typical diverse community was present in NDSU D/B – clients, builders, engineers, lawyers, and so on – along with atypical actors such as students and university administrators,

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nevertheless, the expected and typical adversarial relationship failed to become established. We attribute this to the way risk was assessed: all parties had the same interest. The focus of all parties was simply on ensuring that the project succeeded.

In NDSU D/B, there wasn't a trade-off in responsibility. Instead, the responsibility to design the project, to build it, and to pay for it, all rested with one party (the NDSU D/B program). This meant that students weren't passing their drawings on to someone else in order to construct the building. Students were subject to a budget goal and they were also responsible for fundraising.

Collaborative Authorship and Role-Trading. Based on the culture of architectural practice, authorship for built work can range from teams being credited to iconic design figures being credited and variations therein.[11] The culture of professional practice sees change and discussion when major shifts in personnel occur such as changes in partnerships, implementation of succession plans, changes in financial and legal structuring and the death or retirement of an iconic figure.

In order to allow a majority of the NDSU D/B students to learn from and contribute to all aspects of the large construct, an iterative process of idea development was encouraged where one student might incorporate another person's idea and create a new version, or two or three students would group together to pursue a similar idea contained in their work, or a student might get interested in another student's idea and partner with them through the development process. Progressively, NDSU D/B students developed the ability to explain design problems without the need to propose single-answer or single-author solutions. In this way, delegation of work between students was not a function of skills and abilities but rather a conversation about how a design problem was understood and how the solutions emerged through a cycle of organic iteration and critique. This process eventually developed a culture of collaborative authorship through collective action rather than individual or collective voice.

Figure 4: The completed demonstration cabin at the Minnesota State Fair. (Photo: Mike Christenson.)

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Figure 5: Full-scale prototypes of wall sections constructed by NDSU D/B students. (Photo: Mike Christenson.)

Even though midway through the design semester students self-identified into areas of interest and expertise, the authorship of the overall design ideas belonged to the whole group. As part of this process, the NDSU D/B students engaged in a process of role-trading, which had the effect of preventing a single student or a group of students from assuming dominant "designer" roles at the expense of others.[12] The processes which NDSU D/B created to support pedagogical goals such as collaborative authorship and role-trading differ greatly from processes in professional practice created to support efficient production and communication of design solutions.

Differences in Public Presence and Social Awareness. Not every professional architectural project needs a tangible public presence. Albeit, several projects have significant public presence due to design publications and awards, or large input of public funding, or public entertainment component (e. g., sports stadiums), or projects which suffer damage or collapse. Nevertheless, it is fair to say that the vast majority of professional architectural, engineering, and construction projects lack a strong public presence.

By contrast, we assert that every academic Design-Build project needs to have a very public component. This is certainly true of projects with the typical approach to "service learning" which require engagement with underserved communities. In the case of NDSU D/B, the whole goal of the project was to have an educational impact, revealing ideas, processes, and specific products to a community. In general, the program didn't buy products, but products were instead donated by suppliers with the idea that the suppliers would benefit from the public exposure (i. e., a form of advertising). We don't argue here that supplier donation constitutes a viable cost model for professional practice; it is rather one of the features which distinguishes academic Design-Build programs in general, and NDSU D/B in particular, from professional practice.

DISCUSSION

How could professional practice and construction industries benefit from the adaptation of specific tactics such as direct involvement of designers in construction, role-trading to create targeted and close collaborations between craftspeople and designers, and full-scale prototyping in the design process?

Project Communities. Taking a lesson from NDSU D/B, if industry were to insure projects, rather than insuring individual parties to an agreement, then the inevitable

mistake, oversight, or accident would draw from a single insurance pool. This model for collaboration and liability on professional projects is similar to the approach of Integrated Project Delivery (IPD). NDSU D/B did not set out to emulate IPD; instead, the model emerged over time from the interactions between students, faculty, consultants, suppliers, and project sponsors where a community was created around the project.

Role-Trading. While IPD need not incorporate role-trading as a formal strategy, supervised or mentored role-trading in practice would be the deliberate continuation of the intern's education on the path to licensure. The students who fully engaged this opportunity during NDSU D/B participated in all the aspects of taking an idea to a built construct through the various phases (site analysis, schematic design, design development, construction documentation, fund-raising, materials selection, construction, documentation post-construction) and as a result were the ones who most benefited from the opportunity provided by the program. In order to do this they challenged themselves to assume different roles of designer, manager, energy modeler, spec-writer, draftsperson, architect, builder, construction crew, craftsperson, inventor, grant-writer, photographer, website developer, marketer, teacher and more.

Full-scale prototyping. The lack of full-scale prototyping in the industry is directly related to the premium cost of labor both in the profession and in construction. Unwillingness or inability to dedicate resources to full-scale prototypes can lead to an attitude of reaction rather than collaboration. Whether the profession is reacting to existing construction models, or construction is reacting to the design intent of the profession, misinterpretations can result, leading to unnecessary expenditure. Academic Design-Build, and its integrated use of full-scale prototypes early in the design stage, could possibly more efficiently address this issue.

ENDNOTES

1. Chad Schwartz, Laura Morthland, and Shannon Mcdonald, "Building a Social Framework: Utilising Design-Build to Provide Social Learning Experiences for Architecture Students," *Architectural Theory Review* 19, no. 1 (2014): 76-91.
2. Dana Cuff, *Architecture: The Story of Practice* (Cambridge, MA: MIT Press, 1992), 66.
3. Malini Srivastava, "Passive House as a University Design-Build Start-Up," in *Proceedings, 7th Annual North American Passive House Conference, September 28-29, 2012, Denver, CO*.
4. John Gaber and David Hinson, "Experiencing the Rural Studio: An Assessment of Student Learning Outcomes," in Getting Real (Proceedings, 94th ACSA Annual Meeting, 2006), ed. Renee Cheng and Patrick J. Tripeny.
5. Vincent B. Canizaro, "Design-Build in Architectural Education: Motivations, Practices, Challenges, Successes and Failures," *International Journal of Architectural Research* 6, no. 3 (2012): 23.
6. Canizaro, 23.
7. Jason Pearson, University/Community Design Partnerships: Innovations in Practice (New York: Princeton Architectural Press, 2002).
8. Canizaro, 22.
9. Mike Christenson and Malini Srivastava, "A Proposal For a Cross-Disciplinary Design Pedagogy: Generative Full-scale Investigations," in *Proceedings, 2005 International Conference on Design Education: Tradition and Modernity, National Institute of Design, Ahmedabad, India,* 231-238.
10. Cuff, 70.
11. See, for example, Donald McNeil, *The Global Architect: Firms, Fame and Urban Form* (New York: Routledge, 2009), especially Chapter 3, "Architectural Celebrity and the Cult of the Individual," 59-80.
12. The role-trading process developed out of a pedagogical model for *project exchange* developed by author Christenson in his architectural design studios at North Dakota State University.