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A Student's Introduction to the Realities of Their Designs

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Drawing Conclusions: A Student's Introduction to the Realities of Their Designs

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Abstract: In his book "The Thinking Hand", Juhani Pallasmaa states that, "[w]hile drawing, a mature designer and architect is not focused on the lines of the drawing, as he is envisioning the object itself, and in his mind holding the object in his hand or occupying the space being designed." How then does the beginning design student gain the insight necessary to interpret these representations, these lines on paper? In the field of architectural education, we take on the responsibility of helping these students begin to develop a process of translating the lines they draw into a conscious projection of the resultant construction. This research paper presents a project developed for an introductory building technology course which aims to help second year architecture and interior design students start to make these connections. Through a series of translations, nine groups of students transformed a simple schematic wall section drawing into a fully built construct and, in the process, made intimate and lasting connections between the virtual and the real in the design and construction of a simple architectural work.

Keywords: Architecture, Construction, Design Education

Introduction

In the 1960's, architect Carlo Scarpa was appointed as the Dean of the Venice School of Architecture. Soon thereafter, he had the adage "verum ipsum factum", attributed to philosopher Giambattista Vico, inscribed above the entry doors to the school. It translates simply as "we only know what we make." (McCarter 2008, 193) This aphorism raises the question, what is it that architects make? Architects 'make' architectural designs and the drawings necessary to convey those designs. Architects rarely, however, 'make' buildings. Most architects can probably count on one hand the number of times during their formative architectural education that they were asked to build something using "real" building materials or to explore architecture through full scale investigations. Yet, within this typical educational framework focused primarily on learning factual information and the generation of design through a series of abstractions, the architecture student needs to be able to thoroughly understand this conceptual equation (Figure 1):

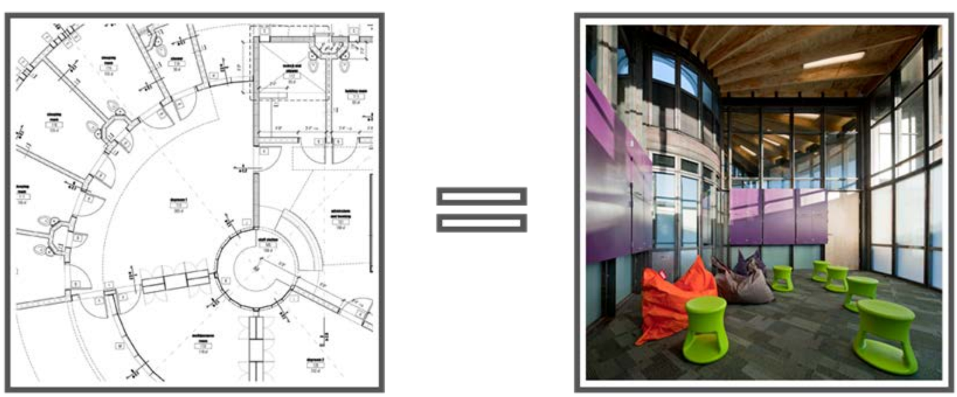

Figure 1: Conceptual Diagram
Sources: Drawing - Mark Ryan Studio; Photo - Bill Timmermann

In his book *Shop Class as Soulcraft,* Matthew Crawford discusses the conflict between 'knowing that' and 'knowing how.' For him, there is an importance placed on universal knowledge (knowing that) especially in higher education that alleviates the learner from needing to be embodied in place and in the act of learning. Crawford states that practical knowledge (knowing how) must be lived to be understood properly. The acquisition of this type of knowledge must occur in situ, within a context that allows for a response to a particular situation. (Crawford 2010, 161-163) In the field of architecture, these ways of acquiring information must be balanced. A focus on universal knowledge, especially early in the education of an architecture student, has the potential to disrupt the student's ability to make the critical translation depicted in Figure 1. Acquiring only the facts and figures without a greater contextual understanding leaves the architecture student with an education filled with gaps and partial truths. Architectural education must strive for more.

This paper presents the pedagogical construct and results of one problem, within a series of three, assigned to a class of second year architecture and interior design students in *ARC 242 Building Technology I* while studying at Southern Illinois University's School of Architecture. Centered on a balance of learning through the acquisition of both universal and practical knowledge, this problem was designed to allow the student to make connections between idea, drawing, and the tangible construction. The students were asked in this problem to transform a simple architectural drawing into a full-scale built work through a series of translations. Each translation of the architecture allowed the student to have a clearer conceptual understanding of its construction and, through this process, these students gained insight into the realities of the lines they draw on paper.

Project Philosophy

Adrian Snodgrass, in his essay "On Theorising Architectural Education," discusses the relationship between theory and practice in architectural education. Working in concert with Crawford's notions of universal vs. practical knowledge, Snodgrass analyzes the terms 'theory' and 'practice' with respect to their Greek origins. His findings define *episteme* (theory) as knowledge that pre-exists the activity of making and *techne* (practice) as the making of something in accordance with *episteme*. (Snodgrass 2000, 89) *Episteme* in this regard has a correlation to universal knowledge, learned out of context prior to the process of making or doing. This definition also helps clarify *techne* as a process of making, but one that is accomplished by drawing on a body of existing knowledge instead of knowledge gained through the process itself. In contrast, *praxis* is the process of gaining knowledge through the application of judgment; it is an exercise in *phronesis* or learning how to respond to a particular situation. (Snodgrass 2000, 90) *Praxis,* therefore, carries the essence of practical knowledge, or, in Crawford's words, "knowing how." Within this construct, knowledge is gained through an embodied process. It is through this paradigm of learning that this problem is centered.

In "The Nature and Art of Workmanship," David Pye proposes the concept of 'the workmanship of risk':

> If I must ascribe a meaning to the word craftsmanship, I shall say as a first approximation that it means simply workmanship using any kind of technique or apparatus, in which the quality of the result is not predetermined, but depends on the judgment, dexterity and care which the maker exercises as he works. The essential idea is that the quality of the result is continually at risk during the process of making; and so I shall call this kind of workmanship 'The workmanship of risk': an uncouth phrase, but at least descriptive." (Pye 2010, 341-342)

The workmanship of risk, for him, centers on the potential risk of failure that exists throughout the process of making when the making is executed by the hands of a craftsman. (Pye 2010, 342)

At any given point, human error could cause a project of this type to be marred to the point where it would be considered a total loss. The workmanship of risk, therefore, is an embodied process and, much like *praxis*, is an exercise in continually responding to the situation at hand. In contrast to risk, Pye also offers 'the workmanship of certainty' as an alternative, one driven by the ideals of quantity production. When working within a system centered on the workmanship of certainty, the quality of the result is predetermined before a single item is generated. Providing the example of writing with a pen contrasted with modern printing, Pye explains that unlike the workmanship of risk (the pen), the workmanship of certainty (printing) requires a great deal more judgment and care prior to starting the work. The work required to carve the metal printing plates, build the machinery, etc. is vastly more complex and demanding than putting a pen to paper. (Pye 2010, 342) Setting up the situation necessary for risk to be sufficiently mitigated necessitates a type of knowledge equivalent to *episteme* or a bank of knowledge that pre-exists the actual activity of making. In the problem presented here, the student is invited to explore the realms of certainty and risk, of 'knowing that' and 'knowing how,' and of techne and praxis through the completion of a series of tasks resulting in the construction of a full-scale work of architecture.

Problem Structure and Process

'Project Assembly' is the second of three problems assigned to the students in *Building Technology I*. The problem statement asks the students to take a given wall section and elevation of a small segment of a single story residence (Figure 2) and use it to build the described construction at full scale. It is the mid-scale problem in the series; the first is a construction document set for a small single-family residence and the third is the design of an architectural detail. This problem also provides connectivity within the course as it is the mediator between the virtual construction of problem 1 and the manual construction of problem 3 and it serves as the sole group based project of the semester.

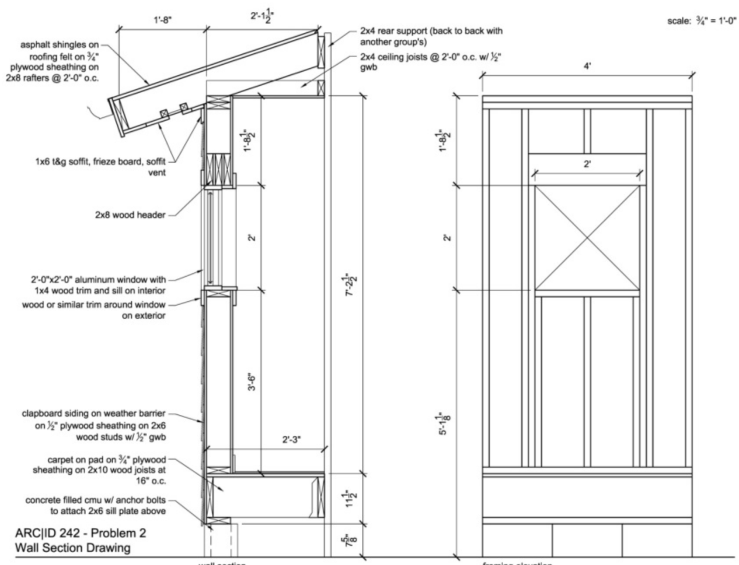

Figure 2: Initial Project Drawing Handout
Source: Drawing by Author

At the beginning of the semester, the students, in groups of seven, were given the drawing sheet shown in Figure 2. It depicts a simple residential wall section with augmentations to the “foundation” and a rear support. The groups were told that this drawing was being provided by the architect (the faculty) and that they, acting in the role of the contractor, were to construct a full-scale mockup of the section for client review. The drawing was put forth as “in-process”; each team would be required to fill in any missing gaps in the given information to allow for the construction to be successfully built. The first task assigned was to analyze the drawing and generate a full list of parts and equipment which would be necessary to build the construction. This task served several purposes within the construct of the project and the course. First, as only some of the parts of the drawing are labeled, this exercise provided a chance to see which of the groups could explore beyond the given information and attempt to seek out answers to the unknown quantities and qualities embedded in the problem. Second, this task was the initial step in creating links between the tangible and the representational. Each line in the drawing had to be considered for what it represented. These lines were translated by the groups into lengths of lumber, sheets of plywood, and boxes of nails. Realizations were made that 2x6s do not come in 6’-10” lengths and that one can cut two 3’-4” lengths of 2x4 out of a single 8’-0” member. Construction waste was, perhaps for the first time, a principle point of discussion for the students. And third, this task marked the initial point of mitigation of the forthcoming workmanship of risk to be undertaken. The categorization and organization of parts provided the beginning of the acquisition of knowledge, of *episteme*, required to “automate” some of the process of the construction of the wall section.

After the creation of the parts list, the groups were asked to take the list of parts to the local lumber yard or home improvement center and create a cost analysis for the wall section. The cost estimates were required to be broken down item by item, excluding any labor costs. This step allowed for an additional point of dialogue between the actual and the representational for the class. It also provided the students with the opportunity to see the wide range of alternatives available and to have tangible contact with the building materials and supplies, many of which were still unknown to most of the students. At the conclusion of this task, the students submitted their cost analysis and parts lists for review by the architect/faculty (Figure 3).

Problem 2 Materials List/Price Analysis

Wood				
	Item	Quantity	Price per Unit	Total Price
Studs	2x2-8'	2	$1.38	$2.76
	2x4-8'	2	$1.97	$3.94
	2x4-10'	2	$2.58	$5.16
	2x6-8'	11	$3.14	$34.54
	2x6 treat-8'	1	$3.99	$3.99
	2x8-8'	4	$4.20	$16.80
	2x10-10'	2	$6.83	$13.66
Sheathing	3/4" Ply	1	$19.97	$19.97
	1/2" Ply	1	$14.49	$14.49
Trim/Other	1x4-8'	6	$1.99	$11.94
	1x6 t&g -8'	3	$10.43	$31.29
	4" Base -8'	1	$10.16	$10.16
	8"Lap-8'	8	$7.22	$57.76
			Total:	$226.46

Finishes/Foundation/Etc.					
	Item	Area	Quantity	Price per Unit	Total Price
Roof	3 Tab	~16 sq.ft	1	$21.54	$21.54
	Felt	~16 sq.ft	1	$15.25	$15.25
GWB	1/2"	n/a	2	$9.10	$18.20
Barrier	Tyvec	~32 sq.ft	1	$43.96	$43.96
Flooring	Carpet	~8 sq.ft	12	$0.52	$6.24
	Pad	~8 sq.ft	12	$0.63	$7.56
Foundation	CMU	n/a	3	$1.54	$4.62
	Concrete	40lb.	2	$2.68	$5.36
Window	Aluminum	4 sq.ft	1	$69.67	$69.67
Vent	Soffit-6'	n/a	3	$1.60	$4.80
Eavestrough	Gutter- 10'	n/a	1	$6.47	$6.47
				Total:	$203.67

Fasteners				
	Item	Quantity	Price per Unit	Total Price
Nails	Roof/Side	1	$8.97	$8.97
	Framing	2	$5.97	$11.94
	Finish	1	$1.18	$1.18
	Joist	1	$4.97	$4.97
Floor	Tac Strip-8'	2	$1.98	$3.96
	J-Hangar	8	$1.17	$9.36
Foundation	Anchor	2	$1.52	$3.04
			Total:	$43.42

Gross Total: $473.55

Final Cost Estimate: $512.62

Group 5: Matt Ollmann, Ava Andersson, Sara Mauerman, Taylor Behl, Nick Ouellette, Michael Young, Dustin Thmason

Figure 3: Cost Analysis and Parts List

Source: Group 5 (M. Ollmann, A. Andersson, S. Mauerman, T. Behl, N. Ouellette, M. Young, D. Thomason), 2012

After gaining the approval of the architect on the cost analysis and parts list, the groups were asked to generate a detailed storyboard of the construction process of the wall section (Figure 4). Each storyboard was required to explain every step in the process of construction, beginning with the filling of the concrete masonry unit foundation with concrete to hold the anchor bolts and ending with the installation of the carpet and the other interior finishes. This task served two primary learning objectives in the class. First, building on the process started with the initial tasks, the storyboard exercise served as the primary means of mitigating the risk in the project for the students. The storyboard essentially served as a trial run through the construction process in the relatively risk free environment of a virtual 3d software package. Although not a true transformation of knowledge, the process of creating the storyboard allowed for some of the knowledge typically gained through embodiment in the construction process to be explored prior to the actual construction process occurring. The storyboard allowed for more balance during the construction of the sections between a situation of certainty and a situation of risk. This interpretation of Pye's states of workmanship are not true to his definition because the means of construction themselves did not shift; however, the increase in knowledge allowed for a significant, but by no means total, decrease in risk during the process of making.

Second, the storyboard assignment introduced the students to the notion of construction scheduling. In the initial attempts at the storyboard, most of the groups demonstrated serious lapses in critical thinking by showing windows installed prior to wall sheathing or interior finishes added before the roof was installed. Through the process of storyboarding, the groups became much more thoughtful about the need to not just attach the pieces together correctly, but in the correct sequence. At the conclusion of this phase, each group submitted the storyboard (Figure 4) along with any necessary refinements to the cost analysis for final approval.

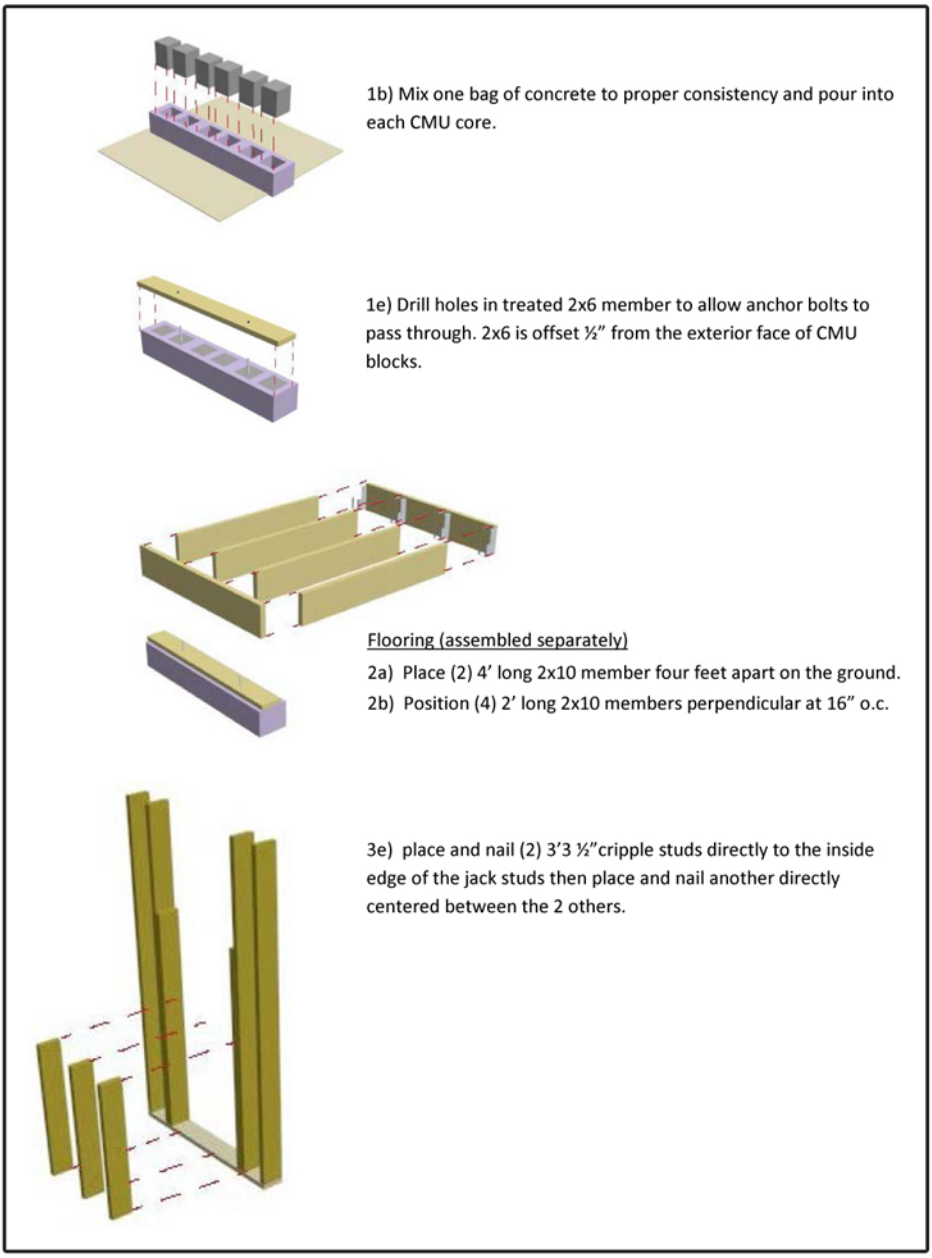

Figure 4: Samples of Storyboard Slides
Source: Group 4 (C. Kilroy, S. Tutka, E. Becherer, D. Baldwin, R. Musial, A. Albers), 2012

After a second iteration of storyboard submissions, which were necessary to reconcile some of the lingering issues mentioned above, all nine of the groups were authorized by the architect to undertake the construction of the mockup wall section. The constructions were built over the course of a single day towards the end of the semester (Figure 5). Eight of the constructions were built in the courtyard of the School of Architecture building. The ninth was built inside in the building in the primary gallery space for display purposes for the school. The students were responsible for purchasing and transporting all of their own materials to the jobsite. A minimal selection of necessary power tools was provided by the faculty for the students to use, but the groups were encouraged to bring with them all of the hand tools they believed would be necessary to complete the construction. To help offset the cost of the project, the students were offered a donation of a 50% discount on all project materials from Lowe's of Carbondale for the project.

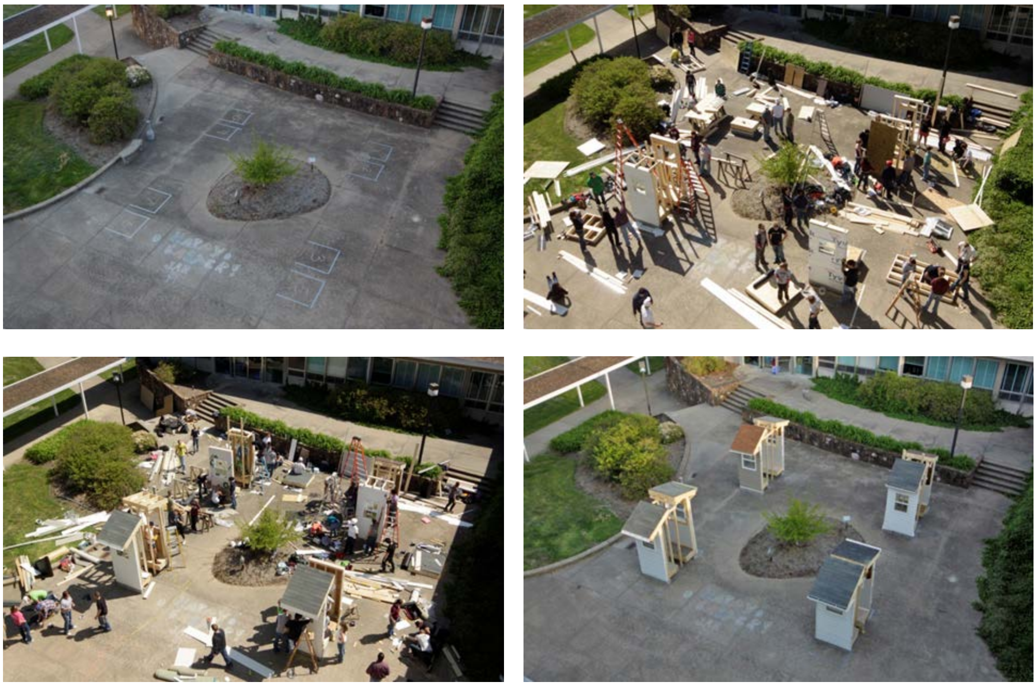

Figure 5: Images of the Jobsite on Build Day - Top Left (Before Arrival), Top Right (Mid-Morning), Bottom Left (Mid-Afternoon), Bottom Right (Completed)
Source: Photos by Author

Over the course of approximately ten hours, each group immersed itself in the realities of construction. For the first time, many students gained a clear understanding of what all of the lines, symbols, components, and hatches from their construction documents actually represented in built form. It was an arduous process. In his essay "Escaping Normality to Embrace Reality," Peter Buchanan discusses his participation in Bryan MacKay-Lyons design/build Ghost Lab in Nova Scotia. Here Buchanan applauds Ghost Lab's "physical learning experience, involving cold wind and rain or blazing sun, tramping in mud or clambering up scaffolding, hoisting materials or wielding and guiding tools." The learning environment Buchanan describes allows for participants to gain more than intellectual knowledge about construction, but also a feel for the materiality of construction and an intimate understanding of the processes, sequencing, and safety considerations undertaken when constructing. (Buchanan 2008, 170) Although on a much smaller scale than Ghost Lab, the ideals remain the same in this problem. Here, 'knowing that' and 'knowing how' merged and, in the process, the lines of the drawing became real; they were hammered, screwed, sawn, and anchored. The lines were carried, lifted, and braced; the lines caused slivers, cuts, and one very sore thumb. The effort the students brought with them to the jobsite that day allowed each of them to begin to learn how to navigate through the representations generated in the practice of architecture.

Analysis

The students in *Building Technology I* completed two voluntary and anonymous surveys during the semester: an introductory survey and an exit survey. Amongst a series of other questions, the students were asked about their interest in learning through hands-on experiential projects. In the introductory survey, the 42 respondents rated their interest level in learning in this manner at an average of 4.6 out of 5.0. For this question, 4 equated to “interested” and 5 equated to “very interested.” The same question was posed to the students in the exit survey. Although this survey received only 19 respondents, the average rating of the interest level in hands-on learning increased to 4.8 out of 5.0. These results suggest the student’s innate interest in experiential learning and reinforces the need for continuing to employ this pedagogical strategy as a learning initiative in the course. Further supporting these conclusions, a separate question in the exit survey asked the students if they felt this problem was an effective learning tool. The average of the responses from the students was a 5.0 out of 5.0.

In addition to the surveys, the students filled out course evaluations at the end of the semester. The students were asked in these evaluations to discuss any successes or failures they saw in the course. The comments regarding this problem were overwhelmingly positive, with 27 students stating either their general appreciation for the project or their belief that the project provided a valuable learning experience. The few critical responses involved strategies for lessening the cost to the students and for more equitable allocation of team members for the project. Both of these issues, along with other faculty observed issues, will be taken into consideration as the project is modified for the next iteration this coming spring. It should also be noted that in the course evaluations, the 59 students who participated rated the learning experience of the entire course at a 4.85 out of 5.0, or a 97%. These results are convincing that the structure employed in this problem was successful and should be continued to be used in coming semesters as this course is developed further. Despite the immensely positive feedback, further iterations of the project are necessary to generate the substantial body of data needed to produce more conclusive results.

Conclusion

In “The Thought of Construction,” Robert McCarter, in reference to Ghost Lab, states that some of the most important architectural lessons we can learn are by touch and through hearing. The hand can feel the weight, grain, and hardness of wood and a nail driven properly into a plank of this wood creates a distinct sound. He expands on this notion by outlining Louis Kahn’s notion of “the marks of making.” These marks include the subtle patterns of nails and the rest of the fine-grained etchings that the construction process tattoos on the spaces we inhabit. (McCarter 2008, 208) Within the construct of a hands-on, embodied learning experience, students are able to not only feel these marks within the process of making, but also to begin to understand how to utilize similar elements in the work they will design in the future.

Marco Frascari has posed in “The Tell-the-Tale Detail” that the architectural detail, or the joint condition, contains both the “*techne of logos*” and the “*logos of techne*.” (Frascari 1996, 500) For him, the detail is the union of construction of space and construing of the making of that space. McCarter describes the experience of Ghost Lab in a similar manner as a place where students gain “the integration of the *thought of construction* through the *construction of experience*, realized in the group’s shared act of designing and building.” (McCarter 2008, 208) Within the construct of the problem presented here, constructing and construing initiate a dialogue and it is through the participation in this dialogue that the students gain the most valuable lessons of the course. Through an active role in the translation of drawing to construction, the students made intimate and lasting connections between the making of drawings and the making of buildings in the construction of this simple work of architecture.

REFERENCES

Buchanan, Peter. 2008. "Escaping Normality to Embrace Reality." In *Ghost: Building an Architectural Vision,* by Bryan MacKay-Lyon, 164-182. New York: Princeton Architectural Press.

Crawford, Matthew B. 2010. *Shop Class as Soulcraft: An Inquiry into the Value of Work.* New York: Penguin Books.

Frascari, Marco. 1996. "The Tell-the-Tale Detail." In *Theorizing a New Agenda for Architecture*, ed. Kate Nesbitt, 500-514. New York: Princeton Architectural Press.

McCarter, Robert. 2008. "The Thought of Construction." In *Ghost: Building an Architectural Vision,* by Bryan MacKay-Lyon, 190-212. New York: Princeton Architectural Press.

Pye, David. 2010. "The Nature and Art of Workmanship." In *The Craft Reader*, ed. Glenn Adamson, 341-353. New York: Berg.

Snodgrass, Adrian. 2000. "On Theorizing Architectural Education." *Architectural Theory Review* 5, no. 2 (November): 89-93.

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