Learning through Making: Accounting for Variable Experience in Beginning Design Students

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The hands-on testing of ideas against an architectural polemic requires that students reevaluate the problem at hand through the lens of their own experience as well as their preconceived understanding of that experience. This approach to the beginning design education allows for and encourages various levels of skills and interests on the part of the student. The hands-on exercise results in a physical and testable artifact that students can assess through criteria which is set by the instructor but ultimately defined by the questions that the student is asking. Thus, the knowledge brought by the student is of the most importance. A student with a mathematics background will bring a different eye to an architectural problem than someone who has had a performing arts education. This approach embraces the richness of a student's own life as a tool with which to differentiate design rather than flatten the work of a student body to a consistent product or set of questions. Through a case study of three assignments taught at various institutions, by various instructors, this research seeks to develop and collect a pedagogy of architectural learning that begins with hands-on making and is closely inspired by constructivist learning theory. Each assignment has a specific focus: tectonics, structure, and thermal performance.

Constructivist learning theory suggests that individuals and society construct knowledge through experience, experimentation, observation, and reflection. Each of the courses and assignments this essay is examining focus primarily on the experience and experimentation aspects of constructivist, or experiential learning theory. Observation and reflection are used primarily as supplemental steps. Paramount to this learning theory is that experience precedes the production of knowledge.

The philosophy of constructivism in education asserts two core principles that are of importance to early design education. The first principle being that "knowledge is not passively received but actively built up by the cognizing subject." (Husen, 162) In the context of a design studio, this makes sense. We know that students working on a design learn through the iterative making process. In design studio, this approach acts to level the playing field as students use their interests to propel projects forward. Where this principle is less apparent is in the technical education of design students and specifically architectural students. For all of the success of studio-based training, the academy continues to teach architectural technologies through the process of replication or regurgitation. Standards, expectations, traditional methods are all taught and evaluated through textbooks and apriori answers which flatten student's educational experience to a homogeneous product that does little to engage students in critical thinking.

David Kolb and Alice Kolb developed a teaching methodology that shares many aspects with these constructivist ideas. This experiential learning cycle consists of four stages: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). (Kolb, 8) While this essay does not get into individual learning styles which Kolb lays out within the Kolb Learning Style Inventory 4.0, it will use the four stages from version 3.1 to discuss how we teach the technologies in the early design student education. Again our interest in this is the quadrants of experience and experiment. Experience happens first. While each student brings to the table their preconceptions and skills to an experience, there is no barrier to the student having the experience in the first place. In our case that may be through the construction of some object. Each of these case studies will draw heavily on active experimentation.

Doing, making, or building occurs as the initial exploratory steps in the learning cycle. These hands-on exercises require little to no preexisting knowledge of tectonics, environmental systems, structural strategies, or architectural theories. Therefore, through testing, failure, and re-testing an understanding of these architectural concepts can be built around a methodological process rather than an ideological preconception.

It should not be miss construed that I am advocating for less technical education of the structures, construction, and thermodynamics in architecture. What I am advocating for is a more exploratory approach of the first principals that drive these topics. An approach that encourages students to explore a concept through making and play. Making being a leveling agent and play being the attitude students bring to the technologies. These experiences though need to be synthesized with the traditional, the standard, and the technical. Students, though, would be served well at the early stages of design education to treat these technical topics as an opportunity for creativity.

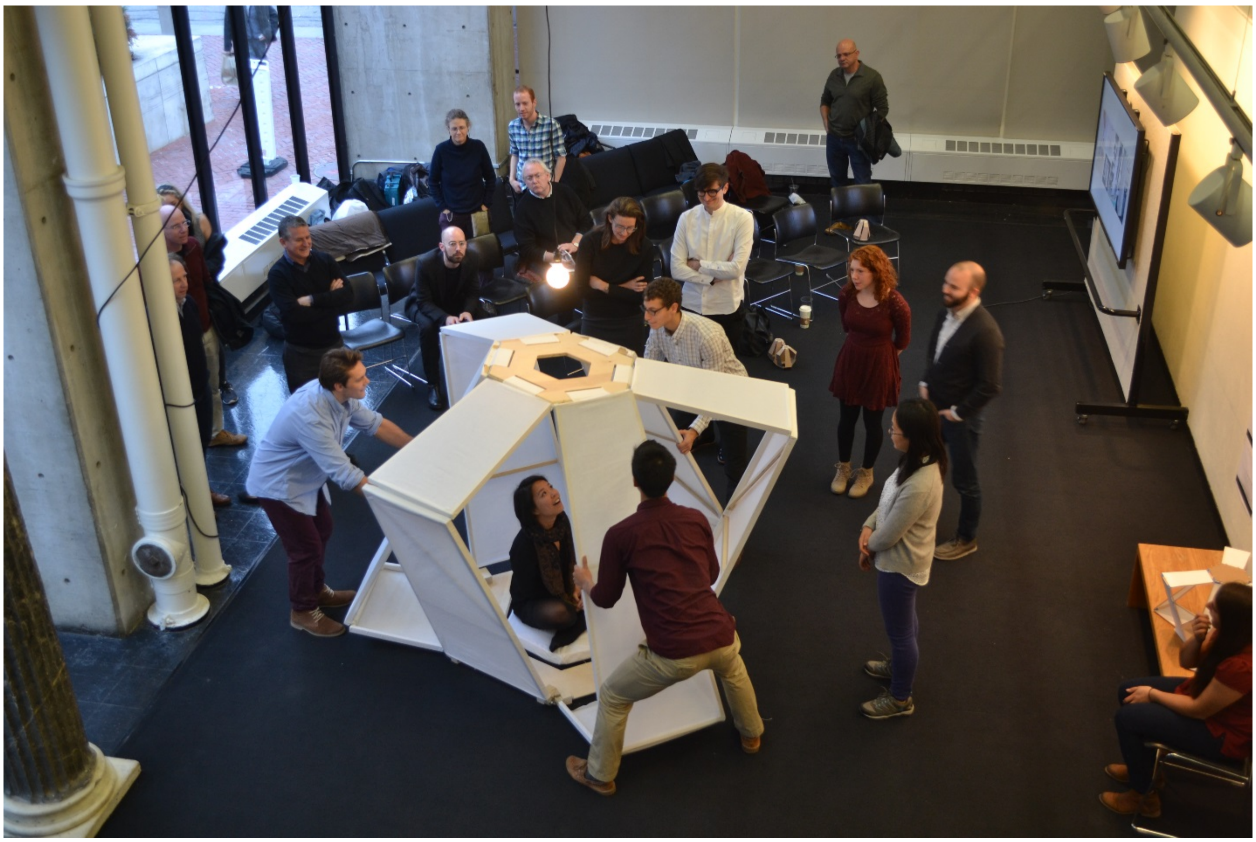

Figure 1: Tectonics Lab Final Review – Photography by Alex Timmer, Harvard University, 2015

Construction: Tectonics Lab

This course is taught by Mark Mulligan and Michael Smith at the Harvard Graduate School of Design. The course is made up of undergraduate students within the History of Art and Architecture program. The course is open to all students though. As a result, while most of these students have a background in art and architecture, many students also come from mathematics, geology, music, etc. This course is structured into four assignments that present students with various first principals and ask them to design and make an object that explores that first principal. Students are asked to think about such architectural concepts as compression, equilibrium, and joint. For example, during the compression exercise, students were asked to design a masonry module that would stack into a wall. The final project for this course, (Figure 1) titled "Inside and Out" asked the students to design an inhabitable structure that uses the principals they learned during the first three exercises. (Mulligan)

Each exercise is accompanied by supplemental lectures and pinups where the work is discussed, but the students drive the conversation. Of relevance to this essay is the fact that students were given minimal direction before they were tasked to start building mockups.

By the time the final project has started the students will have worked on three other smaller group projects. This means that their skills and weakness are known. At the beginning of the work, the students self-organized based on this fact. Those that were skilled illustrators would do the drawings, those that could make models quickly would be in charge of the laser cutting, and those that were adept designers took the lead. While this was not ideal from the stand point of insuring each student gained knowledge in their weaknesses the scale of the project broke down these silos. When it became time to build the project the silos of illustrating, modeling, and designing gave way to the urgency of the build. Each student had to participate in the construction which meant that each student was able to engage, test and interpret the work. Design decisions were made on the fly as testing of their various strategies failed or succeeded. This lent itself to a productive discussion between the students about what mattered conceptually and pragmatically. From David Kolb's point of view, this meant that the students were learning as one of his criteria for learning is that "Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world." (Kolb, 7) This would not occur if the students only worked within digital space as the "dialectically opposed modes" are reduced to an aesthetic choice.

Given their varied backgrounds and skill sets each student brought to the table a specific point of view. This helped to define the role of the instructor and teaching assistants as mediators with the diverse collaboration of students driving the design process.

In general, the project was a success because the act of making allowed for accessibility of a student to the topic at hand through the material. If anything didn't work, it was that the students with some design background charged ahead in the process and resulted in a diminished involvement of the rest of the students. This, unfortunately, is a problem with any group project. No matter how much exploratory making thrives on the naivety of a group of students those explorations can be flattened by a single student whom may have more preexisting knowledge in the field of study. In other words occasionally instead of getting five very different projects, you end up with 5 of the same projects.

Structural: The Bridge Break

This assignment was taught by Mike Utzinger at the University of Wisconsin – Milwaukee in the Fall of 2017. This assignment was taught within the Architectural Technologies 1 course at SARUP. This course is made of up undergraduate juniors and graduate transfer students. It covers a wide range of content, ranging from fundamentals of structure to passive solar design. (Utzinger) This assignment is a familiar one; many institutions use this exercise or something similar to teach students about structure. Students are organized into groups of five and given the task of designing a bridge or truss to span one meter. Testing is done by adding bricks to each bridge until it breaks. (Figure 2) The bridges are evaluated based on their performance, prorated against their weight. By using a camera to document deflection and failure the students are then asked to visually evaluate the failure of their structure and proposed alterations to address it. The ability to make the bridge, here through basswood and glue, is accessible to the majority of the students. Unlike a software program which typically involves a technical learning curve, the physical model is more readily achievable. Again this promotes exploration because the students are not limited by the input methodology of the software. If a student wishes to make an arch, they can do so. If a student wants to make a laminated glue structure that also is immediately achievable. The quality of these two structures is evaluated through the testing and synthesis after the failure has occurred.

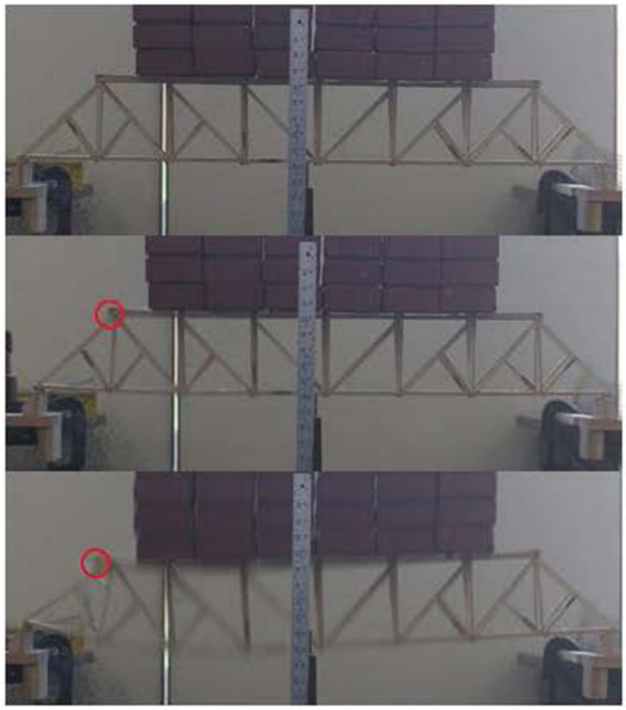

Figure 2: The Bridge Break – Courtesy of Mike Utzinger, University of Wisconsin – Milwaukee, 2017

Two things are successful in this exercise. The first being that the testing of the structures becomes an social event. The students all gathered together in the commons of the architecture to cheer on the bridges. While this may seem trivial, it makes a difference. The second is that the student's assumptions are tested uniformly across the group without applying value to their plans beforehand. What this means is that the success of a bridge is dependent on its performance and not and aesthetic or ideological notion that may be preconceived. A multiplicity of approaches is encouraged not in spite of the uniformity of the testing mechanism but because of it.

Thermodynamics: Mass Matters

This exercise is part of a studio being taught by Alex Timmer at the University of Wisconsin – Milwaukee. The studio is made up of both undergraduate students as well as graduate students. The goal of this exercise is to teach the students about thermal mass through making and testing of concrete samples. Each student is given either an intensive or extensive material property that they are tasked with exploring through the production of material samples. After the initial round of making and testing the student are asked to combine that property with one other of their choice. As in the bridge break exercise, the testing mechanisms are uniform for all of the students. Students would either use an oven or a heat lamp to test the thermal performance of each piece. This uniformity of testing mechanism allows for the students explore their interests. A student's expertise in a process or interest in a specific material is allowed and encouraged. More importantly, the student is engaged in a dialogue with the object that they have made having to balance performative results against aesthetic desire. They ask something of it, to heat up in a specific manner, and then test to see if that assumption or desire is realized. If it is not the student repeats the process, but in that sense the object is operative.

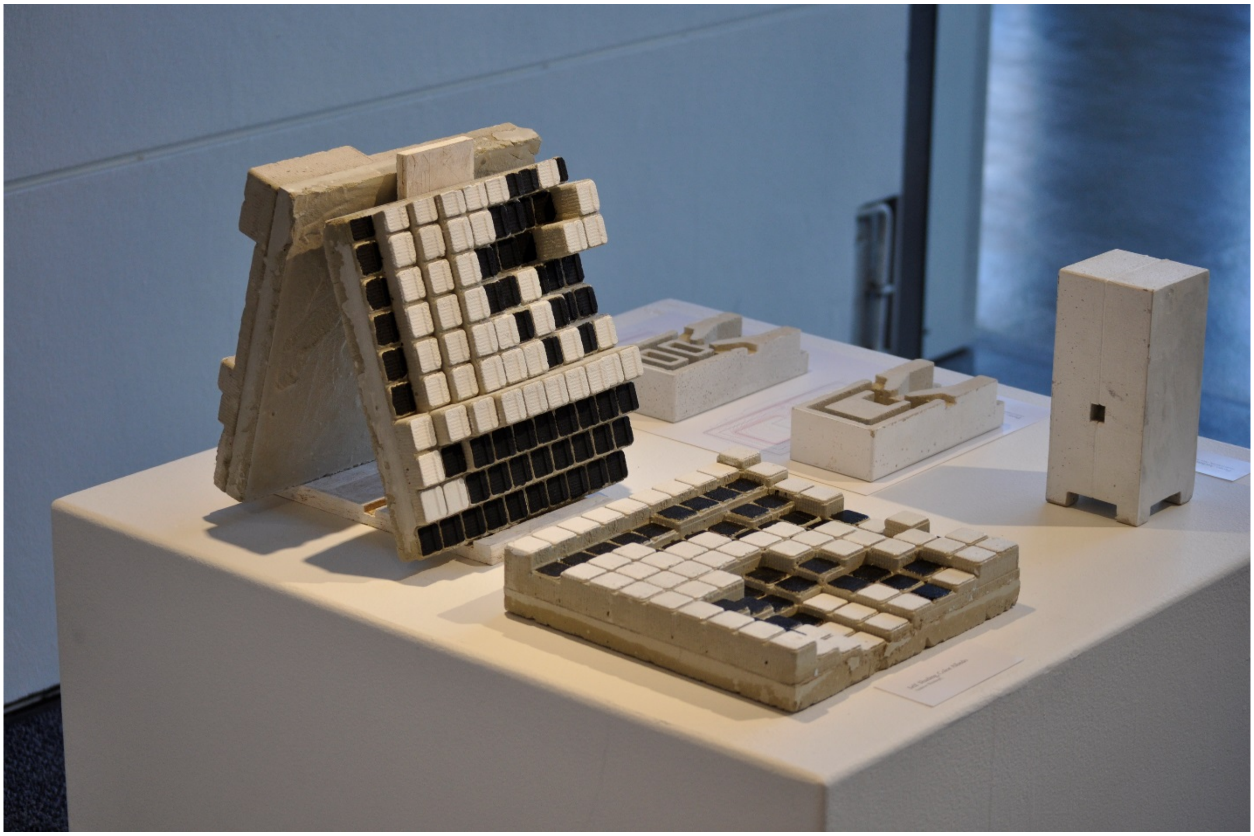

Figure 3: Mass Matters – Photography by Alexander Timmer, University of Wisconsin – Milwaukee, 2017

The operative nature of each of the artifacts in each exercise means that there is no preconceived answer, but only a conversation or a dialogue between the student and their work. The assumption in each of these exercises is that the answer is not known beforehand. Surely certain first principals are fundamental to the process and in that sense immutable, but students are not asked to replicate known examples of thermodynamic technologies. It invites the students to explore, to question, to make and then to evaluate those objects.

These operative artifacts (Figure 3) find themselves between a study model and a finished representational model. They hang ambiguously between these two states. They are far from pristine, but they are highly rigorous and intensely participatory. These objects develop out of an understanding of design as an open system, a series of inputs and outputs, in which the physical object is understood as an active participant in the design process rather than a passive byproduct.

Conclusion

Constructivism asserts that there is a fundamental separation between educational procedures whose purpose is to generate understanding and its antecedent, those procedures whose goal is the repetition of behaviors. (Husen, 163)

Each of these assignments addresses the multitude of background and skill levels by approaching their assignments with this crucial criterion in mind. By attempting to insure that understanding is the goal, there is room for each student interests to be used as the subject for each assignment. This guarantees that the academy does not produce a flat and homogenous set of designers by the end of their education. As a consequence this requires educators to be more nimble and agile in their teaching, having to adjust their evaluative criteria to something similar to studio critiques. Without this adjustment, there is a flattening of exploration. Educators will need to become less ideologically entrenched in their declarative understandings of the world and shift to a procedural set of skills that let them adapt to the continually changing world and student. To reiterate an earlier point, this does not mean we go without the technical aspects or expertise of the various design fields. What it means is that exploration and experimentation happen before the imparting of apriori expectations for designers. These apriori standards are only introduced after a student has had a chance to experiment and experiment with the materials. How standards are introduced, whether as an evaluative tool or a tool for the refinement of their ideas, becomes the domain of the educator. The role of the teacher in this paradigm is more interactive and rooted in negotiation with the students whose questions and interests are valued. (WNET) It sharply contrasts with the current methodology of teaching early technology courses in design which assumes that students are passive individuals which are filled with inert facts. Empowering students to question the assumptions given to them assures more inquisitive and innovative designers who actively engage topics such as structures, thermodynamics, and construction.

References

Husen T. and T. N. Postletwaite (1989) “Constructivism in Education.” The International Encyclopedia of Education: Research and Studies: Supplementary Volume One, Pergamon Press, pp. 162–163.

Kolb, David A., and Alice Y Kolb. (2013) The Klob Learning Style Inventory. 4th ed., McBer and Co..

Mulligan, M. (2015) "Project 4." Handout. Tectonics Lab: HAA 179x. (Professor Mark Mulligan) Harvard University Graduate School of Design. Nov. Print.

Mulligan, M. (2015) "Syllabus." Handout. Tectonics Lab: HAA 179x. (Professor Mark Mulligan) Harvard University Graduate School of Design. Sept. Print.

Timmer, A. (2018) "Serial or: Mastering the Art of the Thermally Active Surface." Handout. Mass Matters: ARCH 650/850. (Professor Alex Timmer) University of Wisconsin – Milwaukee. Feb. Print.

Timmer, A (2015) Tectonics Lab Final Review, digital image, Harvard University, taken 2015

Timmer, A (2018) Mass Matters Student Work, digital image, University of Wisconsin – Milwaukee, taken January 2018

Utzinger, M. (2017) “Project 1.” Handout. Architecture Systems 1: ARCH 301. (Professor Mike Utzinger) University of Wisconsin – Milwaukee. Print

Utzinger, M. (2017) “Syllabus.” Handout. Architecture Systems 1: ARCH 301. (Professor Mike Utzinger) University of Wisconsin – Milwaukee. Print

Utzinger, M. (2017) The Bridge Break, digital image, University of Wisconsin – Milwaukee, taken November 2017

WNET, thirteen.org. (2004) “Constructivism as a Paradigm for Teaching and Learning.” Concept to Classroom, Educational Broadcasting Corporation, www.thirteen.org/edonline/concept2class/constructivism/index_sub1.html.