The Issue of Scale

This paper explores the value of better understanding the particular issue of Scale in Design-Build and the affects with regard to pedagogy. Drawing upon best practices realized through numerous nationally recognized personally coordinated Design-Build or design-construct courses, as referred to herein, this paper considers how The Issue of Scale may be wielded as the operable parameter for the design and the undertaking of a design-construct course.

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INTRODUCTION

Assuming an institution is reliant upon clients "bringing" a design-construct project to the program the result is often a set of parameters, if not mandates, with regard to the scale of the undertaking. Commitments inclusive of faculty efforts, institutional support, cross-disciplinary collaboration, and so forth are often a component of the projects negotiated award and in so doing the faculty involved may be tethered by these obligations. Additionally, a common consequence of a projects scale is the necessity to assign the project to the appropriately prepared student cohort. While always interesting and educational (to varying degrees) this model may lead pedagogies to be subservient to the issue of a projects' scale.

The paper offers a case study of an interdisciplinary design-construct (D-C) team approach illustrating how Mississippi State University is addressing The Issue of Scale. Concepts for work sharing, co-working, and how they, as a methodology for pedagogical and project design, engage Lev Vygotsky's, Zone of Proximal Development are outlined within.[1]

INFLUENTIAL LITERATURE

Dr. Ruth Sinclair, Research Director at the National Children's Bureau, London, offers a series of unique observations in her article Participation in Practice: Making it Meaningful, Effective and Sustainable.[2] In this work she identifies a number of principles relating to the value and the means by which participation may be better understood and engaged. Of particular interest to this pedagogical study is the issue of participation in that without active participant-learners the D-C instructional method is significantly undermine. Sinclair points out that participation (synonymous with decision-making in this instance) may be realized at different levels i.e. scaled up or down. The suggestion is that the scale of participation is a designed parameter, which the adult/instructor regulates to achieve a desired affect. For participation to be meaningful, effective, and sustainable the designer of a participatory

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activity must understand that not all students will engage the activity equally and with the same level of preparedness. Furthermore, participants must be asked to participate using a variety of approaches that appeal to the varied interests of the participant group.

The notion of Power Sharing is functionally linked with this form of education in that for participation to be perceived as more than a powerful consultant simply "listening to / consulting" the student, instructors must be willing to share or even grant the power of decision.[3] In such an instance the educator moves from the position of expert, effectively governing the exchange, to that of a counterpart investigator. This form of student / teacher relationship parallels the highest form of participation as identified in Roger Hart's "Ladder of Participation" model in which eight progressive levels, or ladder rungs, may be climbed on the way to achieving parity among students and faculty instructors.[4]

This insight on the design and negotiation of participation is a key facet to the proper scaling of a design-construct learning opportunity. I suggest the instructor must proactively gauge the student participants' level of preparation, reconciling ability, willingness, prior knowledge, and the work/project to be accomplished such that it falls within their zone of proximal development. Accomplishing all this while also enabling collaborative participation that is generative and synthetic requires one to strategically determine the scale of the D-C activity. Throwing students into an ill considered D-C project will likely result in student hardship in the form of imbalanced levels of participation and the failed synthesis of subsequent anticipated learning.

PEDAGOGICAL OUTLINE

1. How The Issue of Scale may be wielded as the operable parameter for the design of, and undertaking of, a D-C course.

- Scaling a project / requisite student engagements
- Scaling Participation / Collaboration
- Scaling Tasks
- Scaling Durations
- Scaling the unfolding of a project to ensure learning, not only working

Figure 1: Concrete Masonry Unit Development

Figure 2: CMU Development Final Phase

Understanding the level of D-C undertaking a student cohort is capable of engaging critically is paramount to ensuring a productive learning experience. While many educators seek to build as a way of teaching one must be cognoscente of the fact that not all students are ready for any project. Laying out the student cohorts established capacity and desired eventual capacity, i.e. learning outcome, should be the first step in realizing an educational D-C pedagogy. While programs around the country employ D-C as a tool for education, it is not always clear why and to what end the decision has been made to do so. Vagary of learning outcomes is common as all too often the excitement of "landing" funding to build overrules concerns for how and why a school employs and undertakes D-C. Replication and consistency of experience is no small issue when one considers the NAAB criteria to be met. Assuming an institution is committed to an ongoing D-C pedagogy assurances must be made that the students will be primed to productively engage the work. As a mechanism for ensuring the synthesis of an existing curriculum with a proposed recurring D-C course it is vital that the curriculum committee and upper administration be engaged in the course development process. The curriculum committee must be informed of the goals and outcomes one intends for the D-C course. Assembling this group of advisors is one way of ensuring the acceptance and future assistance in founding a sustainable D-C pedagogy. Of equal importance is the necessity to include the upper administration in the development process. To ensure recurring and predictable funding, it is often the administration that has the capacity to court and secure industry and/or private funding partners.

All too often D-C courses are considered to be supplemental to an established curriculum. In such an instance the D-C course is able to run unchecked and unchallenged. While potentially damaging to the program and client, this form of under determined project could have lasting affects on the student participants. Research suggests that episodic learning or one-off activities are not the most effective means of education.[2] Per the research, it is conceivable that in under planned D-C courses ill or null conceived pedagogical goals may result in students become less willing to participate.[5] The intention, as I see it, is to utilize D-C as a means of establishing a way of designing and thinking that is recognized and employed at the same level as other more traditional design education paradigms. If relegated to the position of "one-off" or episodic in nature, the D-C course may be perceived by students and educators as a novelty rather than a defensible and established design methodology.

2. Scaling Commitments inclusive of faculty efforts, institutional support, and co-teaching with shared scholarship.

In developing a sustainable D-C pedagogy I believe it is critical for the institution to insist upon a faculty-team organizational approach. It is a near certainty that dominate figures will emerge within an instructional team (generally based upon seniority or with whom funding is associated) however program administrators must recognize that a sustained D-C program of instruction cannot be reliant on any one faculty member. Helping to establish a democratic platform for D-C courses to be developed, the upper administrators of the program need to be aware that many faculty members are likely to want to participate. The faculty-team approach allows for a degree of fluctuation where faculty members are able to shift positions from high-intensity project coordinator roles to low-intensity instructional roles. Additionally, given the right organizational structure faculty team members are able to share the burden of project hunting and funding procurement. Faculty teams, in this way, model the participatory behavior and learning expected of their students. By sharing obligations and assignments within the D-C faculty team a community

of informed and vested educators may be developed, fundamentally ensuring the institutions enduring D-C pedagogy as a cornerstone of the curriculum.

Effective student-focused co-teaching within a D-C model of education requires of the educators extreme generosity and the maturity to accept that the realized project is firstly the education provided and not the architectural artifact. The D-C artifacts include #1. the Client's Post-occupancy Review #2. Final Budget #3. Schedule #4. Adherence to ADA / Building Codes / HSW / Etc. #5. The Aesthetic and Experiential architectonic qualities, and finally #6. Student Evaluations. Personal design taste should not be the foremost reflection of a D-C pedagogical success. Too often it seems, awards are granted based upon aesthetics with little attention paid to the pedagogical design.

With any D-C pedagogy it is important to note the necessity for carefully delineated research boundaries. With a faculty-team approach the likelihood of internal conflict over publication and scholarship/research rights becomes heightened. The murky waters of team-teaching, while fertile and often productive also hold dangerous and detrimental possibilities. With D-C teaching, the instructional load and/or student contact hours is almost certainly increased, often dramatically. For the instructors this commitment of time and energy is likely to result in the necessity for their efforts to double as scholarly production. In such an instance tensions may be raised as the pressure to "make one's teaching a scholarly pursuit" takes on a new level of importance. Administrators need to be aware of what they are asking of their faculty and the position it places them in among their peers. Shared scholarship is excellent and often demanded by at the university level however a balance must be struck as nearly all educators understand that co-authored works alone will likely not result in a successful tenure package.

3. Reconciling a D-C opportunity with the coursework that must taught.

"Beggars ought not to be choosers" — John Heywood, 1562

Instrumentalizing D-C activities for educational purposes is often the direction taken by institutions eager to claim D-C learning. When the project is offered before a pedagogical structure is developed students run the risk of suffering the affects of poor planning. Just "building stuff" and "figuring it out as we go" is never the way to ensure a successful D-C undertaking. In some educational instances reactionary design and construction may be the goal of the pedagogy however for many this is not the case. In either situation, improvisational design is a clear methodology for design and in so being may be planned to occur within a superstructure of anticipated result. Measures of control in order to ensure particular types/forms/subjects to be learned are the responsibility of the faculty. As a designer of education it is possible to delineate acceptable level of failure as a component to learning by doing however we also should remember that learning from experienced professionals is of equal value. Preparing students to both work with others and/or for themselves is our obligation. The "mystic architect" model of education must be questioned when considering the employment of a D-C pedagogy. The capacity of any program to allow only a handful of students the opportunity to develop a D-C project with complete individuality seems unlikely. Therefore, designing the experience such that the objectives and outcomes are reasonable measurable will generally also lead to an experience that is also replicable and universally available to the entire student body. With architecture programs being put upon by the university, and their accrediting bodies, to illustrate objective learning outcomes, educators must

be mindful of the need to develop D-C as a reputable educational methodology.

Allowing students meaningful play is often necessary, particularly at the foundational level of education. With D-C education the opportunity for discovery learning must be carefully considered. At times the pressure to get things done may be overwhelming, which could have a serious negative effect on the student learning. Conversely, given a well designed D-C structure, students may be exposed to learning activities that are only available when working at full scale and with real construction materials. It is the responsibility of the educator to determine the schedule for the course, the project, and the pedagogical initiatives. While it is understood that often the educators are asked to make many accommodations for the D-C project to occur, there is always the opportunity to direct the projects educational unfolding. The point that is critical to understand here is that at times instructors must eliminate some aspects of the D-C project in order to enable deep and critical learning of design and construction aspects whose level of sophistication and importance is appropriate to the student's capacity. A common dilemma is, do you have the students experience a whole bunch of things or do you have them learn only a few things. Experience vs. Learning is a key condition of any educational activity. The intensity and level of practice one has with a subject often dictates the degree of knowledge establishment, aligning what students need vs. what they may want is the business of the educator.

IMPLEMENTATIONS & OBSERVATION

This section considers numerous D-C projects and/or courses undertaken during the past 3 years. The intent is to highlight projects which were successful due to the careful scaling of particular attributes or project parameters. Three projects are analyzed to reveal both the stregths and weakness designed into the pedagogy. The study begins with the smallest of the four projects, a D-C learning module situated within a three credit hour Architectural Materials undergraduate introductory survey/lab course. In this course students received approximately 60% of instruction through lecture with four projects assigned over the course of the term. The first of these projects was a study of concrete as a fundamental building material. The students were required to come away with what the NAAB would qualify as an Understanding of the content. To achieve this level of knowledge students were first introduced to basic concepts of the material and its methods for installation. The examination came in two parts which included a written battery of questions and a practical that required students to design a concrete masonry unit (CMU) which included a custom face finish and or geometric pattern. The students were required to develop a design based upon full-scale construction tests. Students had to make demonstrate not only production but replicable production with a formwork system that could be reused without degraded results. Additionally, students had to generate construction documents for the formwork which eventually had to be realized by a classmate who was also responsible for casing the form with the resulting CMU being graded for quality.

Project Critique: The project was successful in that students were, in large part, able to reproduce the formwork and CMU's with a somewhat low (21%) rate of failure. The project duration of four weeks seemingly allowed students to synthesis both lecture and practicum lessons through the development phases of the project. Scaling the task with the students' level of prior knowledge seemed appropriate with students first only being asked to focus on the CMU as an individual unit. Upon the generation of a first attempt students were ask to incorporate the ability/necessity for the units to be aggregated as a wall system. The incremental development

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afforded students the luxury of not needing to know everything about the CMU's aesthetic, strength and system-based performance criteria. Working to develop first one, then two, and finally all three performance metrics allowed for a systematic digestion of CMU attributes.

Conversely within the same course students were asked to develop a residential scale entry door built of 2" x 6" x 8' SFP grade wood studs. Students were given three weeks to design and construct the doors, one door per two student team. In this project students were again given lecture and practical instruction prior to beginning the D-C learning module. The doors were to hang and operate as an exterior entry door would. This meant developing a design that could negotiate the issues of water proofing, shrinking and expansion, wind and sound mitigation.

Project Critique: The Issue of Scale was not well considered in this instance with students being ask to consider too many issues outside of their zone of proximal development. While the students were able to conceptualize the design from an aesthetic point of view the issues of materials and methods of construction seemed to have overwhelmed the students. With the CMU project, performance criteria was limited and I believe due to the minimal issues of weathering and waterproofing associated with concrete construction the CMU project was less open to detrimental critique. The vulnerability to weathering inherent to wood construction introduced a set of wholly unique issues. The ability for students to consider and predict how the wood would weather involved a level of knowledge beyond most students. In this instance the project was not properly scaled with regard to the feedback loop generated by the material/method of construction and effects of weathering. The materials dynamic character was not clear to the students and they were consequently not able to competently design means of control and/or material movement accommodation. Furthermore, the necessity of familiarity with fastening methods and joinery types scaled the number of project parameters outside of an achievable level. I believe asking students to make too many overreaching educational leaps likely created a state of lowered investment. When asked to operate well outside of a student's establish knowledge domain one must be careful not to disenfranchise the student to the point of refusal or productive paralysis.

Figure 3: Entry Door Development

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The third project considered from the position of scaling is a setoff prototypical pedestrian and light vehicle bridges yielded by a three credit hour special topics elective course. The footbridges are located in the Crosby Arboretum in Picayune, MS, home to the Pinecoat Pavilion by Fay Jones. In this instance the instruction required the scaling of three primary project parameters. The first major parameter was the necessity for prefabrication caused by the nearly 200 miles of separation between the students and the site. Second on the list of scaling issues was the project budget which was extremely limited at only $1,300.00. The final scaling consideration was the student expertise and ability to undertake such a project. This course included nine students, two of which were landscape architects, one building construction science student and the remainder architecture. Most students were freshman or sophomore level students with minimal construction and/or tectonicly informed design experience. For the project to be successful the scope of the design had to be scaled by the instructors with material and construction methods carefully limited to allow students to deeply engage core issues. A value-based project triage was prepared by the faculty, to inform students of the rationale behind exclusion of particular materials and methods. The approach taken quickly focused student efforts toward realizable concepts and schematic proposals. Issues of construction logistics were carefully introduced at the early stages of the course, with students being systematically informed of the pitfalls associated with certain materials, methods, and project schedules. The resulting project concluded with students claiming success. The careful planning resulted in both bridges being constructed and installed on budget and on time.

CONCLUSION

Undertaking design and construct as an educational methodology requires a holistic approach. At Mississippi State University the mission to provide universal and inclusive D-C learning as a consistent component to the student experience has be widely endorsed. Through the structured cooperation of the administration and the faculty we have been able to establish a cultural and curricular expectation that students will graduate with the confidence instilled through first hand D-C experience. Our consensus was hard earned and in outlining *the Issues of Scale* faced at MSU it is hoped that other institutions might better prepare for the inclusion of Design and Construct learning.

ENDNOTES

1. Berk, L & Winsler, A. (1995). “Vygotsky: His life and works” and “Vygotsky’s approach to development”. In Scaffolding children’s learning: Vygotsky and early childhood learning. Natl. Assoc for Educ. Of Young Children. p. 24
2. Sinclair, R. (2004). Participation in practice: making it meaningful, effective and sustainable. Children & Society, 18(2), 106-118.
3. Cairns, L. (2001). Investing in children: Learning how to promote the rights of all children. Children & society, 15(5), 347-360.
4. Hart, R. A. (2013). Children’s participation: The theory and practice of involving young citizens in community development and environmental care. Routledge.
5. Shier, H. (2001). Pathways to participation: openings, opportunities and obligations. Children & society, 15(2), 107-117.

Figure 4: Completed Bridges, Crosby Arboretum

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Figure 5: Installation of prefab. bridge foundations