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Building the Fundamentals with a Plastic Water Bottle: A Methodology for Architectural Design Education

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Abstract

During the semester-long Fundamentals of Design studio discussed in this paper, students were introduced to principles of scale, spatial organization strategies, environmental responsibility, and teamwork through an upcycling project that used the discarded plastic water bottle as a building block. The outcome was a built spatial condition on campus that symbolized the need to address plastic waste and was the product of student learning by doing. Active engagement is at the core of the methodology for architectural design education presented in this paper, which focuses on the application of various professional and design skills.

Keywords: Design Education; Architectural Design; Design-build; Environmental awareness; Fundamentals of Design.

1. Introduction

Education has long been associated with lecture halls and seats facing the lecturer. Professors disseminated, students received. The roles were so defined that listening in class as a student or lecturing as a professor became part of a drill. The alignment between subject matter and student interest highly influenced this reality that nonetheless remained unchanged. Dewey (1938) revolutionized education by arguing for experiential education which was student-centered and focused on learning through experience as opposed to learning from texts and teachers. Experience here is not equated with education but is selected or set up based on principles of continuity and interaction. Continuity being the potential for an experience to promote growth which is not the mere accumulation of knowledge but the growth of character, attitude, and aptitude for learning. Interaction being all transactions between the learner and an environment that make up an experience. Though Dewey does not prescribe a specific method of application, he does, however, discuss notions related to education such as social control that stems from the exercise of participatory authority and the nature of outward freedom – that of physical movement- and its relationship to intellectual growth. Kolb (1984) builds on Dewey's ideas by stating that "learning is the process whereby knowledge is created through the transformation of experience." Transformation occurs through individual reflection after a concrete experience, then abstract conceptualization followed by active experimentation. The cycle begins again with concrete experience and can be initiated at any of these four stages. This cyclical model according to Gibbs (2013) links thinking and doing or practice and theory. Reflection, though an individual/personal activity, needs to be encouraged by the instructor through writing or conversation. One could consider it a way to consolidate or understand the subject matter.

In Schools of Tomorrow, John and Evelyn Dewey (1915) emphasized how "work and play of the school should be children's work and play," in other words, students should enjoy learning. By introducing the learning-by-doing approach to education, the Dewey's proposed that "Handwork" in addition to studying is a great aid in holding a pupil's interest and attention. Learning by doing has greater implications in the context of this argument, where education becomes an active social process, engaging students in hands-on experiences and real-world scenarios making learning a present experience of life rather than a preparatory phase for the future. Back in Ancient Greece, school or scholē referred to "leisure" or "free time" dedicated for the improvement of self. This was contrasted with work done to earn a living. If work and play become interrelated as Dewey suggests, learning becomes more effective. As Alfred Mercier phrased it: "What we learn with pleasure, we never forget."

Given the nature of architectural design studios in architecture schools, many of what was discussed earlier is applied. A typical design studio is project-based with students conceptualizing, drawing, writing about, physically modelling and presenting their design concepts/ideas. A plethora of skills, knowledge, values and interactions are covered. A design studio is also flexible enough to involve students in various activities or experiences. Architectural education usually follows the master-apprentice model where students work on a project under the guidance or lead of a "master" or teacher. The educational relationship in this model starts off with asymmetry in competency and authority between master and apprentice, to then be balanced out once a student takes charge of their own work (Schumacher, 2021). This educational model was also applied in the Bauhaus where students had to enroll in a training workshop with a master of craft and a master of form to bridge industry with aesthetics. Walter Gropius (1955), founder of the Bauhaus, shares some of Dewey's views on education by stating that the true aim of all education is to "stimulate enthusiasm towards greater effort" and where training in handwork is an "irreplaceable means of education." Fostering enthusiasm towards creative production, one could argue, comes naturally for an architect where "work is done for pleasure" (Malecha, 1988).

One of the most relevant, effective and influential developments in architectural education is the rise of live projects or design-build (D-B) studios. In designing and then realizing the design through building it, many soft and professional skills are learnt along the way. A D-B studio is a hands-on experience that may focus on large-scale projects that serve a community in question such as those of Rural studio at Auburn University in Alabama, founded by Samuel Mockbee. While other D-B studios are more experimental focusing on the making of 1:1 scale models to bridge the gap between design and physical reality such as Christopher Alexander's "living structure" approach at the University of California, Berkeley. The full-range of D-B project types, regardless of scale, involve students in a "social process" (Meynell, 2019) which include communicating or working with a group or even several stakeholders. The territories of educational D-B, as Stephen Verderber (2019) states, are student empowerment, sustainable practice, placemaking, community engagement, critical regionalism, tectonic innovation, socio-political advocacy, disaster mitigation, interdisciplinary knowledge mobilization and D-B as a reflective pedagogy. The educational D-B studio presented in this paper engages with some of these territories in an attempt at building the fundamentals of design with first year students.

2. The Fundamentals

Among the territories the D-B studio -discussed in this paper- engaged with, are student empowerment, sustainability, and placemaking in addition to applying or building various design and professional skills in the process. The project focused on upcycling discarded plastic water bottles into a spatial condition/structure on campus. This involved several activities which will be discussed in depth in the next section. The fundamentals the studio intended to build align with the above-mentioned territories of an educational D-B studio.

According to Delport (2016), the collaborative nature of D-B studios empowers students to make decisions and builds responsibility towards the team. This is achieved when the professor leads the project as a team member versus as a superior which entails including students in the decision-making process related to the project. In this scenario, "control is social" (Dewey, 1938) and is merely a by-product of having a common goal. It becomes a question of how to engage students in this "game" and setup an environment of collaboration and active participation. Student immersion in a culture that values teamwork and participation will serve students as aspiring professionals as well (Larson, 2015), given the structure of most design practices. It will also shift the dynamic from "primacy of the individual"- highly emphasized in architectural education- to "primacy of the group" and individual responsibility (Nepveux, 2010). Walter Gropius (1955) explains how leadership and service are interdependent, for an architect "must serve the people and simultaneously show real leadership."

Hence, the responsibility towards the team is echoed at a larger scale with a designer's responsibility towards society and the environment. The environment in which people live whether at the scale of the neighbourhood or the scale of the globe is of pressing concern for the designer. Building environmental awareness in architecture school is critical for it will influence all forms of creative output and will infiltrate to ethical responsibilities as well. "The ethical issue is part of the professional identity" (Joger, 2020). Solving architectural environmental problems "leads to "future architects aware of and connected to real life problems and their responsibilities" (Joger, 2020). D-B as a sustainable practice entails addressing some of these concerns through recycling, upcycling, or reuse of materials.

According to Stephen Verderber (2019), the D-B territory of placemaking focuses on how strongly built artefacts contribute to their surroundings. This, in addition to questions about space, site and overall form are common in D-B studios. The temporary nature of the project, presented in this paper, introduced placemaking through the design process, by addressing users, scale, circulation, space and location. It was important for students to understand human scale and how that influences the experience of the structure and its resulting effect on site.

The studio had clear learning outcomes related to three of the D-B territories: Placemaking, sustainable practice, and student empowerment. Additionally, the course was conducted for first year students and intended to build basic design skills, and an understanding of human scale and spatial organization.

3. The Studio

The studio had two lines of work running simultaneously before the building stage. The first line of work was concerned with designing a structure using discarded plastic water bottles and the second involved initiating a collection campaign of discarded plastic bottles on campus. Students moved between individual and collaborative work and designing and realizing.

Initially, each student brought a 500 ml water bottle to class and was asked to measure it using a tape measure and to draw the water bottle technically on an A3 paper, scale 1:1. In a second exercise, students measured their own bodies to produce a drawing that compares the scale of the bottle with that of their bodies- scale 1:5. The intent was to deduce and visualize the approximate number of water bottles needed to reach human scale (Figure 1.). In these two exercises,

students differentiated between the 1:1 and the 1:5 scale, which allowed them to technically scale objects down and identify the role of scaling in representation.

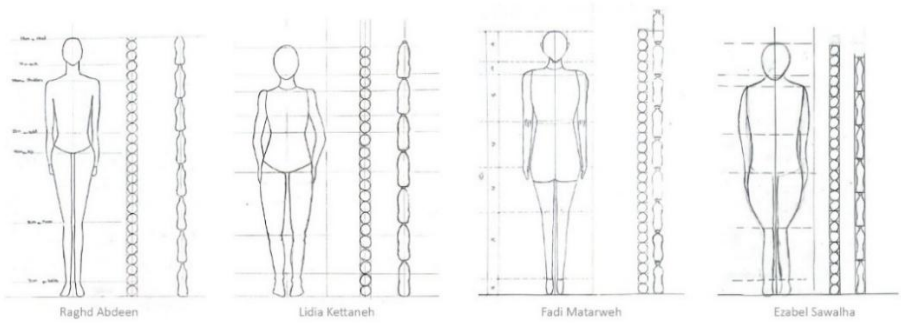

Figure 1. Samples from student work; scale comparison drawings.

Following a lecture on Francis Ching's (2007) organizational strategies: Centralized, grid, linear, clustered and radial, students were required to design a wall formation that adopts one of these strategies. The wall formations had to take into consideration circulation, human scale, and overall site setup. The implications of adopting a linear versus a centralized configuration were discussed in terms of how the structure will function on site. This was to present the process of space-making and related considerations. Through drawing the top and side view of the designs at a scale of 1:20, basic architectural drawing skills were applied (Figure 2.).

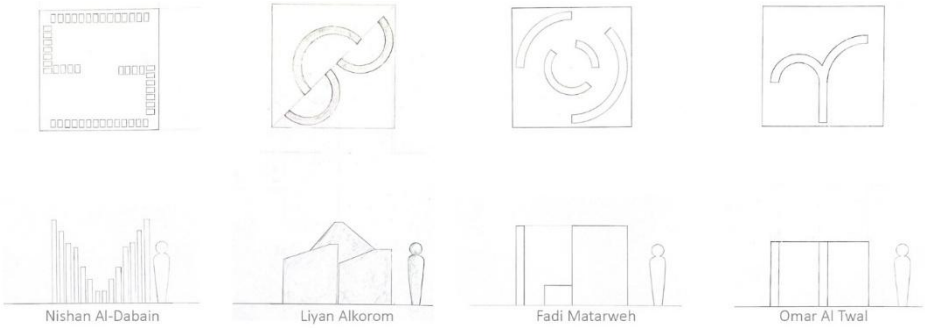

Figure 2. Samples from student work; top and side views of design proposals.

Using round wooden sticks (1cm in length and 0.3 cm in diameter) to represent water bottles, students modelled their designs (scale 1:20) by stacking the sticks as they would do if the walls were made up of water bottles (Figure 3.). Not only did this replicate the process of building with bottles, but it sought to give a better understanding of space, scale and the process of architectural design.

Figure 3. Samples from student work; physical models of design proposals.

The second line of work focused on the collection of discarded plastic water bottles which involved initiating a collection campaign by designing and distributing collection containers, posters, and leaflets on campus (Figure 4.). The process necessitated engaging the local student community, which empowered students to make their own decisions, be part of a movement and carry responsibility as part of a team.

Figure 4. The collection campaign of plastic bottles, initiated by first year students on campus.

Following a series of pin-ups, group discussions and lectures on the importance of upcycling, and reducing plastic waste, the final design was agreed on, and the build stage was initiated. The stage began with sorting collected plastic water bottles and filling some with dyed water for structural stability. The water-filled bottles were stacked at the bottom, and students took turns stacking the rest of the bottles and gluing them together using double-sided tape (Figure 5.).

Figure 5. Students in action.

The final structure (Figure 6.), though temporary, was the result of student collaboration, engagement and commitment. It stood as an artefact that critiques the problem of plastic waste through upcycling. Most importantly, it is the fruit of a semester-long design-build process that sought to introduce learning-by-doing at multiples scales and allowed students to reconcile their drawings with the real structure. This process intended to "connect not only the hand and the eye through the act of creation, but the hand, the eye and the thought behind an architectural design" (Carpenter and Schlemmer, 2015).

Figure 6. Discarded plastic water bottles used by first year students to build a spatial condition on campus.

4. Findings

The effectiveness of the educational methodology was measured via a survey distributed to students following the completion of the course. The survey asked students to state the degree to which they agree or disagree with a list of seven statements. Some of the statements addressed the fundamentals the studio intended to build such as building environmental awareness, an understanding of scale and space-making, and a collaborative attitude. Other statements questioned student enjoyment and studio preference. With a 50% response rate, the results reflect general success where most participants expressed agreement with the statements as shown in figure 7.

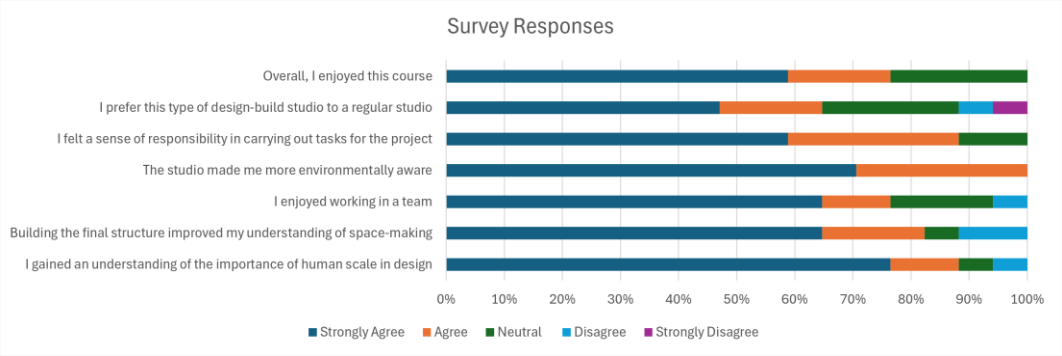

Figure 7. Survey results summary.

5. Conclusion

The D-B studio project discussed in this paper, presents a methodology for engaging students in various activities that build on their knowledge, skills and enthusiasm for learning. Conducted to first year students, the studio aimed at constructing a holistic experience that serves as a continuation and expansion of the requirements of the creative field. To experience, as discussed earlier, involves interacting with the environment and maintaining an aptitude for learning. The learning-by-doing approach to education is presented as a means of creating a learning experience that necessitates active engagement. This project and its associated activities are designed to sustain students' interest, engagement, and enthusiasm for learning.

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