A BIO-EXPERIENTIAL MODEL FOR LEARNING CREATIVE DESIGN PRACTICES THAT SUPPORTS TRANSFORMATIVE DEVELOPMENT IN BEGINNING DESIGN STUDENTS

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Abstract
This paper asks what beginning design learning experiences best support the remainder of design education. It is a conjecture of brain-based learning theory that a student’s direct, concrete primary experiences are responsible for the construction of fundamental structures of neural processing as “hard wired” pathways. These structures then form the ground of and set into play patterns of later more abstracted learning experiences. Pedagogy of basic design courses that seeks introduction of creative processes as a foundation for design education must recognize these experiential, biologically developmental relationships as basic to developmentally appropriate beginning design curriculum.

This paper models a beginning design pedagogy on developmental relationships between concrete and abstract processes of learning as a basis for transformative creative thinking that enables student self-development that progresses up the curriculum. Aligning with developmental learning theories (Piaget and others), a basic tenant of this approach is that learning at the primary level of direct experience self-initiates brain changes where students form their own structure of learning. Thus, initial learning experiences will be those that best enable decision-making consistent with the biological interactivity between body and mind, between, respectively, the concrete and the abstract. This is important because the designed environment in which we all live is grounded in the development of abstract content experientially based in concrete material physicality. Experiential learning theories (Kolb and others, following Piaget) identify concrete and abstract learning as fundamental poles for acquiring and acting on knowledge: Concrete learning involves direct experiential engagement through heuristic discovery and reflection and abstract learning involves indirect representational cues in acts of conceptualization, synthesis, and experimentation. The pedagogical model of this paper proposes a cycling of concrete material experiences and abstract learning experiences into an interactive transformational interdependence as a model of creative design processes that engages student self-development toward maturation. In addition to explication of this theoretical background, an introductory design course sequence following this model will be demonstrated:

Initial course - Students typically enter introductory design studios as visual learners, where the saturation of media has for them abstracted the world and overwhelmed concrete experience. A central pedagogical concern of the initial course is to redevelop awareness of the balance of concrete and abstract experiences in everyday human engagement by “reinitializing” students to the primacy of their relationship to the physical world through activities of making. A sequence of projects immerses students in
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working through direct experience, within the material, sensorial realm, enabling discovery and manipulation of a material’s “workability” in uncovering design ideation. Learning about materials is learning about design. Making necessitates heuristic investigations and discoveries brought to light through cyclical reflective observation and comparative critique. Modes of conceptualization and experimentation are implicit in working with materials to complete projects.

Following course - Following neural development by direct experience, abstract conceptual mechanisms are introduced to develop a context of representation against which concrete investigations become balanced, thus building lessons of abstraction upon lessons of concrete experience. Abstraction includes such issues as diagramming, analysis, visual thinking, representational devices such as drawing, modeling, simulation, scale, context, use of narrative and metaphor, and the nature of ideation. Projects focus on theorizing conceptual approaches and developing experimental proposals in which concrete experience and reflective observation are implicitly engaged as the raw material of creative, abstract thinking. By engaging in design processes as structured concrete and abstract creative discoveries, students build an experiential dynamic of making-thinking-doing-reflecting to actively make sense of creativity in design. Learning to abstract, when grounded in concrete experience, is learning to design.

Keywords
Beginning architectural education; design pedagogy; making; experiential learning; student development.

Biological Imperatives for Learning
An issue to be addressed in developing design curricula is to construct beginning design learning experiences that support the remainder of design education. As an apt analogy, consider a baby in the world of objects for the first time. It will roll and frolic in the grass, reveling in its presence against its skin, in its hand. The baby’s fingers will fondle and finesse the blades, press into the mass of roots, break and tear. Learning takes place at the fingertips. As new connections are made to the concrete physicality of the world, representations of that experience are constructed. Each new contact becomes a test of those representations against each successive contact. Concrete experiences are thus impressed upon the abstraction of mind, literally constructing new synapses and restructuring nervous circuitry. Our nervous systems, as characterized by philosopher William James, are “grown to the way in which they have been exercised, just as a sheet of paper or a coat, once creased or folded, tends to fall forever afterward into the same identical folds.”

Primary experiences in which college students first engage similarly form basic structures of neural processing, and these in turn, inevitably and profoundly form mechanisms of learning for successive educational experiences. What is more broadly called into question is raised by the very fundamental nature of first-year education itself: how can beginning design learning experiences be constructed so as to form patterns of learning that are most beneficial to subsequent architectural design and studio education learning experiences?

Robert Leamnson, in Thinking about Teaching and Learning - Developing Habits of Learning with First Year College and University Students, parallels theories of brain-based learning in defining learning as involving changes to brain neuro-structure that are self-initiated primarily through the ability to detect patterns of experience and make self-correcting approximations through self-reflection. Thus, first experiences are paradigmatic, as they establish a biological patterning of learning
for future learning experiences. First learning experiences set in place conditions for the reception of learning. The brain, as the hub of the nervous system, is experienced as the seat of consciousness in the abstraction of mind but because our nervous systems have their origin in our bodies as our bodies establish a relationship to the physical world. It is the body in concrete relation to the world that provides the basis of nervous transformations.2

The biologically formative nature of concrete experience casts initial learning experiences as those that enable self-initiated decision-making consistent with the biological interactivity between body and mind, between, respectively, the concrete and the abstract. Education psychology identifies concrete learning and abstract learning as two opposing yet complimentary and fundamental means for acquiring and acting on knowledge.3 Concrete learning methods are facilitated by immediate experiential contact in which there is direct engagement through heuristic manipulation and discovery, followed by reflective observation and judgment. Abstract learning involves mental mechanisms and cognitive comprehension utilizing indirect representational cues and symbols in acts of conceptualization, synthesis, and experimentation. Interactive cycling of concrete and abstract modes form the basic staging of learning and pedagogy.

The relationship of concrete and abstract learning at the basic level of a baby’s world is primarily a reciprocal one of sense perception and action. In experiencing the grass, the baby is set to understand something about its place on the grass and the grass itself. Shown only a picture of the grass the baby will not gain understanding. A picture is a representation of grass and is therefore an abstraction from the grass itself. Placing the baby in the grass provides direct experience of its physical qualities and gives the baby an opportunity to self-correct and learn from concrete experience by making approximations as an adjustment of its own representations of grass. The baby’s relationship to the grass is one of learning by doing - a heuristic process of trial and reflection in a feeding on the concrete in a complex interactivity with the abstract in which each mode mutually modifies the other as knowledge and experience develop. “Hard wiring” develops according to one’s association to the world in concrete experience.

Cartesian mind/body dualism is an opposition between abstraction and concreteness that is not reconcilable. However, dualism as a complimentary relationship is descriptive of other basic human relationships such as thinking and doing, thought and action, mind and hand, and, for design, materials and intentions. The successful practice of architecture is itself grounded in the development and expression of abstract content experientially bound into concrete material physicality. For example, architect Steven Holl’s design process develops architectural experience as a perceptual recombination of heightened sensory experience and ideational encounter.4

Recognizing these basic relationships can help cultivate their interactions into foundational learning experiences. This paper will discuss the significance of constructing biological imperatives for learning and model first year design pedagogy on relationships between concrete and abstract processes of learning as a basis for the continued development of design
process and maturation beyond first year. In modeling these processes, the intent is to identify and actualize essential and enduring aspects of concrete and abstract learning processes that are both specific and universal in foundational education in architectural design and that result in a structural approach that holistically defines transformational interdependence between these elements without reliance on forces outside the model.

**Pedagogy as the Forming of Relationships to the World**

Fundamental to this pedagogical model is a basic premise of psychological theorist Jean Piaget - that learners actively and purposefully create their own structure for knowledge as they seek to make sense of the world from their own experiences. Piaget described four stages in the development of schemata, patterns of operational concepts that come about as the child structures its own representations of the world. In the initial “sensorimotor” stage, schemata are formed in actions taken while making direct, concrete connection with the world. The infant develops symbols within the schemata as a way of mediating between its perceptions and the actual objects or events in the environment. In the second “preoperational” stage, roughly from age 2 to 7, children will develop the ability and intentionality to let one thing stand for something else (“symbolism”), even though they depend on contact with the concrete world. Additionally, children also develop the use of reflection to help them test and think operations through logically in the preoperational stage. During the “concrete operational” stage, from age 7 to 11, children become able to engage with concepts but depend on relation of the concepts to tangible or concrete situations. In the “formal operational” stage, Piaget’s fourth and final stage of development, children age 11 to 15 are capable of reasoning abstractly about the same concepts through the use of propositional thought using symbolic representations (e.g., words; thoughts; mental images) without requiring constant reference to concrete objects or events. Another way to describe this stage is when they are able to think about thinking.

What is meant by abstraction? All abstractions are an abstraction of something. The act of abstracting is movement away from the concrete. There must exist a causal referent of any abstraction. “The only way we can become familiar with symbol systems, abstractions of reality, is to move from known realities to the symbols of them.” Childhood development, according to Piaget, demonstrates that the development of the ability to learn is an interdependent relationship between concrete experience and abilities for abstraction. Abstraction does not replace the concrete, it is its complement. Piaget’s ideas are also significant because they stress the idea of developmental relationships, that one act of learning is built upon another as structure, as an evolving representation of mind/body/environment interactions analogous to a kind of mapping of our nervous network onto our activities and onto the world itself.

Expanding on the developmental theories of Piaget, David Kolb re-developed experience as a basis of learning into continuous and phased learning cycles. Kolb’s process of learning cycles is typically portrayed as revealing one’s “learning style” and has been construed into
many applications for education theory. Analysis of “learning styles” for architectural education is not the subject of this inquiry. Rather, it is the structure of Kolb’s learning cycle diagram that is significant. Basic to Kolb’s experiential learning model is that learning is thought of as a process whereby concepts are derived from and continuously modified by experience. Kolb believes that, “Learning is the process whereby knowledge is created through the transformation of experience.” The process of experiential learning can be characterized as a four-stage cycle involving four adaptive learning modes: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Movement from stage to stage is a transformation of the other stages.

Two distinct basic learning activities are identified as opposing poles in Kolb’s model of experiential learning: perception and processing. At one end of the perception pole is concrete experience (apprehension, real, human, sensual, intuitive). Experiencing is immersing oneself in the “doing” of a task, not reflecting on the task, but carrying it out with intention. Opposing concrete experience is abstract conceptualization (comprehension, representations of experience, mental imagery). Conceptualization involves interpreting the events that have been noticed and understanding the relationships among them. It is at this stage that theory may be particularly helpful for framing events. In processing, the two poles are reflective observation (intention, reflecting upon past experiences and many views) and active experimentation (extension, testing and utilizing ideas raised by an experience). Reflection involves stepping back from task involvement and critically reviewing what has been done and experienced. Skills involved include attending, noticing differences, and communicating analytic judgments. Experimentation involves the new understanding and its translation into predictions about what is likely to happen next or what actions might refine the way the task is handled.

Learning experiences that cycle through Kolb’s “dimensions” achieve a more holistic learning experience. That is, students first experience, then reflect on it, then analyze it, then act on it. In this approach the learner will recognize that some modes in the cycle are more productive and will identify types of learning that may be more beneficial. This cycling fosters a meta-cognitive awareness of the learner’s own learning processes and helps the student to

Figure 1: The Experiential Learning Model of David Kolb (Source: Author) -- after Kolb.
engage in self-initiated learning.

**Biological Consistency for Beginning Design Learning Experiences**

Comparing Kolb’s experiential learning cycle to the pedagogy of typical design studio experiences yields some striking similarities to activities that already and routinely take place in studio education. Design students readily engage in concrete learning experiences in the form of making things and engagement in first-hand material explorations. It could be said that concrete experience is in large part the actual content of design, in that actual buildings are the surroundings and circumstances of an occupant’s everyday life and comprise the ordinary state of consciousness of the things around them. Design is also a highly reflective activity, with formal and informal design critique at the center of studio efforts. Reflective activity in the form of design inquiry also takes form as search for sound measures of design. Abstract conceptualization in design occurs within the development of meaningful ideational structure for a design project and typically occurs in the form of discursive thought and conceptual development, and visualization. Representational structures, such as diagrams, drawings, verbal descriptions and discourse, material models, and virtual models seek connection of abstract concepts to the realities of human sentient experience and physical materiality. Active experimentation occurs as concepts take form as the raw materials of architecture (i.e., configurations of walls, floors, openings, spaces, forms, materials, structure, and construction). This process repeats in a cycle of evaluation and refinement.

A pedagogical model for studio education based on Kolb’s learning cycle pairs making and thinking as dialectically complimentary operations. Key to actualizing this structure of activities in the design studio is Piaget’s notion that each student self-initiates their own operational conditions within new mental structures. Some will conceptualize and be informed by making; others experiment with making and discover/develop conceptualized thought; still others “receive” conceptualizations primarily through reflective activity (such as critique). Designing always occurs with respect to a varied set of conditions that necessitate varied modes of learning activity. In respect of these distinctions, a supportive and integrative pedagogy will allow, fertilize, and propagate methodological
interacting in the context of design studio to facilitate a “community of design.”

**Initial Course - Making and Reflecting**

Beginning design pedagogies confront students with abstract learning experiences within tasks such as diagramming, conceptual thinking, visual thinking, representational drawing, and reductive exercises that intend understanding of basic design “elements and principles.” However, beginning design students have little experiential basis for these specific abstractions of architectural inquiry. Additionally, it is a common goal of beginning design pedagogy to overcome student misconceptions about design and visual learning acquired principally through the saturation of media. However, developing new nervous pathways in students requires developing sensitivities for the processes and qualities of concrete experience and the physical world in balance with abstract experience. Making is an important first step in rewiring students' nervous pathways, as it fosters material and construction sensitivities through concrete experience.

The first learning encounter can structure relationships between abstract and concrete processes through engagement in the concrete experiences of making things, followed in turn by engagement in reflective critique of the things made. Making is an immersion in concrete experience through direct experiential manipulation and discovery of a material's workable properties in relation to design intentions. Engagement in acts of making has its premise in the notion that making decisions about materials is making decisions about design. Projects that require acts of making necessitate that students employ heuristic investigations and discoveries that are brought to light through on-going reflective observation and comparative critique. Modes of conceptualization and experimentation are implicit in working with materials to complete the projects. Workmanship is a constant measure of intentions and is brought into awareness as a fundamental category of design and material qualities.

In the initial undergraduate design studio course of the College of Architecture at the University of Texas San Antonio, students engage creative design decision-making directly through hands-on transformational projects as a precursor to the near-exclusive use of abstract, representational, scale drawings in the following studio design course. Thus, all design projects are completed in one-to-one scale and involve drawings only as transformative devices. Projects are structured in a developmental sequence where each project transforms into the next, forming continuity from the scale of the hand to a final, habitable built project. The learning environment consists of efforts in design and making bound with critical review of these efforts - a cycle of thinking and making that necessitates reflection on the previous project(s) as knowledge grows through direct experience. In this way, students develop as individuals as well as designers.

**Project 1 - Place for a rock**

In the first class students are introduced to design by designing something. Presented with a 3' length of bendable wire and a rock, students are asked to design an "orderly support for a rock" over 15 minutes. Following their work is a discussion about aspects they considered in making design decisions, their conceptions and
preconceptions, and the processes of design as invented and discovered. They are then asked to refine their design and reconceive it, making a second refined version for continued discussion. The follow-up project is to design and make a place for a rock substituting paper for wire while retaining the “design concept” of the first orderly place. A review and discussion follows about the nature of material and the effect of workmanship on design decision-making.

**Project 2 - Index card tower**

The consideration of structure is primary to building design. Central to the efficacy of structure are the physical properties of the material comprising it. In an in-class project, teams of four students construct a tower of 3 x 5 folded index cards, making it as tall as they can. Team members typically confront preconceptions of ideas about structure and in working as a group. Trial and error processes are discovered as primary in learning that falling down has as much to teach them as building up. Critical review of all projects enables not only celebration but comparative judgment and fosters self analysis of design processes as well as one’s own decisions.
Project 3 - Printing project

Developing a design project necessitates many iterations until a creative or conceptual focus begins to guide design decision-making. Often these iterations are heuristic, trial-and-error explorations. The print projects set up this kind of learning experience. Working individually, students transform a pictorial drawing of their own place for a rock into a geometric structure within a rectangular plane. Through readings and demonstrations they learn about and apply a regulating geometrical armature (e.g., golden proportion, Fibonacci, etc.) derived from the rectangle itself to establish the basis for building an ink block print. Emergent visual cues such as depth, layering, and space are key to raising questions about what to do next. Central to this project is the introduction to the necessity of workmanship as a part of design - a link between ideas and their realization in material. Typically, good workmanship is achieved by first making a mess, then realizing that won’t do. One well-accomplished final print is the expectation of project criteria, created as a result of a “path” of design iterations. A composite presentation of all developmental steps is produced at the end of the project as a reflective synopsis about process and their own decision-making and as an aid in explaining conceptual decisions to the class. It is at this point easy to express to them that good speaking means good thinking. The print project establishes design as a series of developmental decisions, rather than a moment of grand inspiration or stylized mimicry.

Figure 5: Printing Project Utilizing Geometric Regulation. (Source: Author).
Project 4 - Relief: plaster
The suggestion of layers and depth in each student’s block print is the basis for transformation into a raised relief. Learning objectives include trial and error processes to successfully transform print into relief, developing geometries and learning how plaster and mold materials work. Students realize that a plaster relief contains compelling material qualities for design and that material qualities are necessary considerations for design. Architectural design is not merely a good idea or a clever pattern.

![Figure 6: Project 4 Relief Study in Plaster. (Source: Author).](image)

Project 5 - Frame, panel, volume
The suggestion of volume in the plaster raised relief is creatively extruded into layers of three-dimensional blocks of solid and void constructed of chipboard. Issues such as pattern, depth, volume, movement, layers, thickness, and surface are developed within or between ordering planes. It is realized that geometry is critical to order. Linear pieces of basswood are then used to transform the chipboard construction as a modulated system. Wood as a material must be addressed - its strengths and weaknesses, its joinery, and the fact that wood creates planes only at the edges, resulting in transparency and the emergence of space as a primary aspect of design as distinct from material presences.

![Figure 7: Project 5 Frame, Panel, Volume. (Source: Author).](image)

Project 6 - Frame, panel, space, mass
The suggestion of volume, plane, and frame in Project 5 must now be transformed through the addition of mass and the amplification of
space. It is realized that Interior is a vessel that reveals architecture. Interior relates to exterior. Panel, mass, and frame enclose and thus develop architectonic relationships with space through the ordering of geometry. In the making of the project it is realized that detail and architectonics are merged - how materials are joined gives significance to architectural design decisions. Ideas and building are simultaneous. In project review it is realized how materials speak within the language of designing and how limitless creativity can be.

Project 7 - System of light
Light has no scale, so light at the scale of the desktop will perform as in full scale. Students design/construct an architectonic system of panel, frame, mass, space) that reveals four places for light: place(s) for a source of light; for illumination; for the presence of light; for shadow using materials studied in Projects 1-6. Project review leads to discoveries, especially when different projects are compared when illuminated. Realized in review is that interior is a container of light that reveals architecture and that perceptual aspects of illuminated surfaces and spaces evoke emotional qualities in relation to architectonic systems. Also realized is that the room in which the project is displayed becomes part of the project. Illumination is architecture. Illumination is also a product of workmanship and workmanship is revealed by illumination.

Project 8 - The space of the body
The presence of the self in the space of the room that was realized in the illumination of the room in Project 7 was not acted upon because the
project was “over there on the table.” In project 8, two students develop a dialog between themselves and the space of their bodies using only constructions built upon their bodies. Implicit in body is the act of movement and the space surrounding the body, which are both specific to a particular body. This is key to the development of the project. Body anthropometrics (i.e., limits, motion, dexterity, size, etc.) become design constraints - the project must “fit” the two specific bodies. Project construction necessitates the measure of the body and the measure of kinesthetic movement between two bodies. Only three different materials may be used. The project must be performed, so the project becomes designed as a choreography of body movements that define and celebrate an event of communication.

Project review puts students in the unfamiliar place of being “on stage” with two results - the project breaks social barriers and builds a culture of design discourse. The project creates commitment to design because the designer IS the project, not an object apart from the designer. More significantly it is discovered that transforming the body mediates and structures time and space and celebrates and makes elegant the relationship of body to the built things of the world.

**Final project - The body in space: full-scale project**

The final project is specifically structured to link acts of making and thinking in the context of an experiential learning model of pedagogy. Student teams design and construct an “incident of human occupancy” assigned from basic activities common to public streets. Constructed projects are assembled into the form of street at final review. Direct experience initiates the project as students are sent to experience, discover, and identify basic forms of human occupancy. Common bodily experiences, reduced to a single word (i.e., anxiety, anticipation, etc.) are assigned to student teams as the basis of the project. Materials are limited to wood lattice strips, a binding material for joinery, and sheer fabric. Glue and external mechanical connections are forbidden. A 6’ x 6’ site for each group along two parallel rows of sites that formed a “street” in a plaza of the campus. The project is a comprehensive culmination of the sequence of previous projects. The group project fosters
dialog within the task of designing and making a project beyond the scope of an individual student. Each group was then challenged to find common ground as they conceptualized, experimented, strategize, and built a model of a design proposal. The actual refinement of the design occurs in its full-scale construction. This gives rise to detail. This is the key lesson of the course experience - there is as much design in the concreteness of detailing and fabrication as there is in abstract conceptual thinking.

Following Course - Abstraction / Experimentation

After experiences in making and reflecting in the initial studio course, the following studio introduces design process utilizing abstract conceptual mechanisms to elucidate and develop a context of representation against which concrete investigations maybe balanced. Abstract design activities include issues such as diagramming, analysis, drawing conventions, modeling, simulation, scale, context, as well as the use of narrative, metaphor, and the nature of ideation. Although engagement in abstract
conceptual modes of design follows the notion that learning to abstract is necessary to design, abstraction is always built upon concrete experience. Projects are developed to introduce theorizing a conceptual approach and developing an experimental proposal in which concrete experience and reflective observation are implicitly engaged as the raw material of abstract thinking. Having fulfilled experiential learning objectives by manipulating materials in the initial design course, the subsequent design course first introduces students to the abstraction of representation and scale inherent to drawings and models. The project sequence builds on the use of these abstractions in projects that introduce design as an ordered and intentional creative process in dealing with issues such as site planning, site analysis, human interaction with space, structure, materials, color and light, and accessibility. All design projects provide creative design opportunities and as such also that enable personal development consistent with a beginning level of student development.

Project 1 - Transition into Abstraction
The initial project transitions students from full-scale material and making-based design projects to the abstract use of representational drawings and models. This project alternates concrete and abstract processes (building and making, un-building and un-making, respectively) as actions necessary to integrate the making with more abstract thinking. The project sequence builds on the use of these abstractions in projects that introduce design as an ordered and intentional creative process in dealing with issues such as site planning, site analysis, human interaction with space, structure, materials, color and light, and accessibility. As the concrete

world is the intentional goal of design processes, representation is necessarily linked with physical substance. Without representation, developing intentionality in physical substance is limited. Work progresses in transformational stages.

1] Disassembly - Each student systematically disassembles a toaster and then uses all components to construct new spatial compositions with the parts, which are them drawn and photographed. Objectives of the phase are 1) to discover the nature of assembly and the manner in which the components were designed to support this assembly, and 2) to reveal new possibilities based on material qualities and relationship of parts. Making drawings of the toaster parts compositions develops explicit awareness of the physical actuality of the object and its subtleties.

2] A Dialog of Spaces - The next stage asks students to create “spaces in dialog” that explore spatial organizations as introduced in their reading of Francis Ching’s Architecture - Form Space Order. Students design and build based on their understanding of the physical interrelatedness and nuance of the toaster parts when used to develop spatial relationships. Diagrams are drawn to augment discussion and students make design decisions that identify, clarify, and refine design intentions.

3] Model of an Environment - Scale figures are introduced to transform the spatial model into an environment that can be viewed as habitable and scaled. Perspective drawings view the model at human-scaled eye level (as well as continued practice of perspective). While it is recognized that the environment is abstract, it nevertheless offers creative opportunities for
interrelationships of spaces and the possibilities of architectural components, both analogous and literal. Objectives of this phase are to: 1) critically transform the design based on material qualities related to occupancy issues as found in a scale model, and 2) explore differences between degree of enclosure as a function of the differentiation and articulation of spatial dialog, type of occupancy, and the nuance of material.

4) Scale Drawings - Since this is the first experience students have with scale drawing following their Visual Communications courses, the final assignment of the project is to construct representational drawings in half-scale that explicitly utilize drawing projection methodology between plan views, elevations, and sections. In addition, students develop perspective views that can be modeled on views gained by visual exploration of their toaster construction by holding it up to the eye at a scaled eye-level.

Figure 13: Project 1 Project Supporting Transition into Abstraction. (Source: Author).

Figure 14: Model Simulation Photography at Eye Level. (Source: Author).

Figure 15: Scaled Drawings of the Object Reconfigured. (Source: Author).
Project 2 - Information Kiosk
The kiosk project is a transformation of the toaster project, the first step of which is to draw a diagram of the spatial organization of the final configuration of the toaster project. This diagram is a beginning of the kiosk design (an entry and two areas that support a small open-air public display of architecture student projects). Spaces must manipulate natural light for display of objects and flat art. The hypothetical campus site is an outdoor, flat level area with full sun exposure and pedestrian access. Students study solar orientation as a modifier of form to control day lighting within the project from a selected palette of three materials as a transformation of those suggested in the thicknesses and differences of materials in the toaster project. A final model and composite drawing develops skills in communicating building concepts, materials, and views with orthographic and perspective representations.

Project 3 - Campus Student Center Project
The student center project offers educational objectives that extend student abilities for complexity and development, while introducing basic analytical tools used in the disciplines of building design. It is the first project in the design curriculum in which each student is asked to develop his or her own conceptual direction, so it is controlled in scope as a logical “next step.” A project where the student is both the client and the user group challenges preconceptions and causes students to extend themselves outside their own worldview.

The students themselves are the primary occupancy group of the program - a student center with a small cafe, study areas, and spaces for multiple purposes, including large outdoor gathering areas for performance or lecture. Thus, the project studies varieties of public and private experience of both individuals and groups. Sited in an open space on campus between a circular plaza walk and the rectangle of building facades, analysis of site leads to a realization of great potential
for interaction with geometries of the campus plan as conceptual generators. Students are also introduced to analysis of patterns of human occupancy in a group project that sends them to local cafes to observe, sketch, and photograph the way people interact in the space of a café, its plan, scale, lighting, and materials, both as public visitors and cafe workers. The flexible building program enables each student to make choices about program components they believe are fitting for the campus. Control of day lighting and prevailing breezes is also a factor because the structure is not heated or cooled mechanically. A primary factor for design is that this building will become iconic for campus identity at many scales. The project timeline allows development of many iterations as cycles of model and drawing, as a cycling from concrete and experiential to abstract and conceptual.

Project 4 - Introduction to Color and Light
The purpose of this project is to introduce color and light as implicit design factors in architectural design situations. The project begins with experimental mixing of paint pigments to address color variations, thus building understanding of the basic concepts and vocabulary of color systems. Simultaneously, students are engaged with photographing a place between buildings hour by hour during the course of a single day and laying out the photographs in sequence for continued color analysis. Specific hues in each successive photograph are matched with paint mixes revealing changes in hues due to reflective light. Students observe that color is not an absolute and is related to the adjacent environmental color, and issues such as light color, light direction, and time of day.

This experience is then applied to a design project with each student constructing a large-scale model that enables them to directly observe, and then refine, daylighting effects applied to a small program for a student lounge. This model...
simulation works precisely because light has no scale – daylighting effects in a model are equal to that of full-scale environments. Students photograph the models in different solar orientations to understand lighting effects and color variations. This exercise also instructs about the value of model-making to assist in design decision-making. Three rendered perspective drawings communicate interior daylighting conditions in morning, mid-day, and late afternoon. Students come to understand that drawing light well also means drawing shadow and that effective representation of lighting conditions must involve an observer’s imagination as much as depict what actual illumination. Underlying this project experience is, of course, an understanding of the movement of the sun during the course of a day (i.e., altitude and azimuth related to latitudinal location).
Project 5 - Residence for Artistic Production
While the final design project of the semester serves as a comprehensive project, it also addresses specific design issues such as structure, context, programming, exploration of other art forms, interior experience, as well as daylighting, color, materials, model-building and composite drawing methodologies. The project is located in a cavity of space between two contiguous, fire-resistant party walls. Each student develops a program for both an artist's living space and for the architectural support for the work involved in production and display of their selection of one of four art forms - ceramics, photography, found art, woodworking.

Project design development involves determination of structural systems and a daylighting strategy conceptually unified by a program for the living and working artist. Students build a study model to explore a three-dimensional strategy for spatial organizations while simultaneously developing structural systems. Section drawings are utilized to study the vertical aspects of their proposal and the penetration of daylight by placing their model...
in sunlight. Daylight penetration demands complex interaction with spatial and structural organization. While requirements for a model are to develop and express day lighting, structure, and space through concrete exploration in a model. Drawings complement a model by representing material finishes and, to some extent, an experiential character of the spaces (i.e., spatial qualities, materials, lighting effects, and colors). Although there are many specific submissions due in the cycling of model and drawing exercises through design processes, the final drawing takes form as a single composite drawing, a format that causes thinking of a design project as storytelling.

**Conclusion: Doing (concretely) and Thinking (abstractly)**

“Thinking is too easy. The mind in its flight rarely meets with resistance. Hence the vital importance for the intellectual of touching concrete objects and of learning discipline in his intercourse with them. Without the check of visible and palpable things, the spirit in its high-flown arrogance would be sheer madness. The body is the tutor and the policeman of the spirit.” - Ortega y Gasset

It is impossible to be convinced that teaching by beginning with traditional, abstract, standardized, non-heuristic learning will “produce” the kind of students who will thrive as designers of our physical surroundings. They will instead, I believe, prioritize abstraction in their design work and will not value the realization of these abstractions. Instead, they will create an environment that necessitates “abstract reading and interpretation” that negates issues of substance and individual valuation of direct experience (i.e., materiality, light/shadow, proportion, materiality, connectedness, etc.) and, most importantly, the affective and physiognomic effects of the material world on the reception of any abstract content. It is healthy skepticism that questions that abstract learning should or can prefigure experiences of making. Students that learn design “backwards” in this way inevitably seek to provide only “what the instructor is looking for” as a solution to their design projects because their use of abstraction has no ground in their own experience of the world as their own bodies become shut out of the learning experience. Teaching design by making things must comprise students’ first learning experiences.

It is not the author’s objective to apply Piaget’s developmental stages or Kolb’s learning cycle as an exercise of applied science. To the contrary, I am advocating mind-body unity in the classroom that, simply stated, places the direct experience of our physicality in the world as the ground for abstract, cognitive development of design intelligence. For architectural designers, abstract learning must always account for the physicality at the heart of their work. Buildings convey ideas. But architectural ideas are conveyed to an experiencing occupant only when linked, by necessity, with the perception of a building’s material and spatial presences. These physical ties form the ground of abstract ideas and give body to conceptual representations that are otherwise formless. The mere idea of “giving body” to representation describes precisely a more unified relationship of mind and body. Images and representations (ideas) “of mind” originate in sensations of the physical world. This origin does not vanish or drop from significance.
once the mind forms a representation. In fact, the continual renewal and reconstruction of neural networks is testament to the continual contact of the nervous system with the physical world. Educational systems that recognize this structure do so by providing direct experience as ground for cognitive development. Groundless abstract conceptualizing situates design problems as mental structures with at best a weak connectedness to the physicality that must, ultimately, find resolution in materials and space. As a foundational experience for architectural design education, learning exercises that are principally abstract in nature disassociate designing from human perceptual experience and lead the student to believe that the value of their work (and the built environment) lies principally in representational content. Experiential content is devalued and marginalized or forgotten.

Heuristic methodologies that underlie the utilization of experience as a basis for learning locate abstract content by way of the student’s own selection, experience, and discovery. More importantly, this puts the student in charge of his or her own learning through dialog with self through decision-making, trial-making, self-critique, material exploration, and process selection. The teacher’s role becomes responsive rather than formulaic - partners in design rather than omnipotent masters. This alleviates the teacher from having to deflect students from looking for “what the teacher wants” toward looking for what they can discover, critique, think about, and take action upon. If first educational experiences establish conditions for the reception of learning, then helping students to make their own inquiries sets a pattern that can only reinforce studio education.

Learning structures analogous to those in Kolb’s experiential learning model are always already embedded in design studio methods. However, to be optimally effective studio pedagogy must elaborate a structure of learning that allows experiential learning as a basis for abstract learning. Pedagogies of beginning design courses that seek to introduce design processes as foundational for success in architectural education must recognize that synthesizing physical reality with abstract content necessitates the integration of concrete and abstract learning experiences. Specifically structuring design activities as cycles of making and thinking constructs design experiences that are dynamically interactive. Explicit engagement in concrete experience as self-initiated learning experiences grounds the complex situation of learning in which students act, observe, challenge, and reflect, allowing them to construct for themselves a dynamic process of learning and doing in which the holistic human experience of buildings can emerge.

Notes
3. Woolfolk, Anita E. Educational Psychology, Allyn & Bacon 2000
A Bio-experiential Model for Learning Creative Design Practices that Supports Transformative Development in Beginning Design Students

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References


York: Allyn & Bacon.


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