A Six-Course Meal for Technology of Design

Chamila T. Subasinghe

Abstract

Entry-level technology studies in architecture often baffle first-year university students, and academic staff in turn tend to resist teaching foundational studies in the technology of design (ToD). ToD has often been considered "high risk," as evidenced by a high proportion of dropouts and retakes, and has been deemed the least preferred subject among both students and academics. Based on activated awareness of design as a mode of pedagogy, the new learning design transformed technology education, enabling students to learn through technology interaction instead of theory recitals and memory testing. The improved undergraduate ToD unit took on the form of a project hub, and the technology that students studied was immersive and hands on. This new learning design utilized real-world occurrences. When students could apply concepts and gain a clear grasp of their principles, learning outcomes became spontaneous. Design activism, which was conceptualized in the six-course meal model, built excitement around learning and assignment tasks. Backed by established learning and teaching concepts such as the controlled guidance procedure- and scenario-based learning, the ToD unit achieved increased student performance by reducing effort, inhabiting learning, and facilitating memory retention. The increased performance and retention rates among students demonstrated that design activism can help students approach learning via cyclic deductive–inductive learning routes with multiple entry points.

Keywords: Deductive–inductive learning circle; design activism; learning design; technology of design

The technology concepts articulated in architectural education take an integrative approach to respond to ecological concerns that account for the environmental impacts of development (Guy & Farmer, 2001). The learning outcomes in technology of design (ToD) lay foundations for key technological concepts in architecture. However, students struggle with these advanced concepts, and teachers often avoid having to teach technology, particularly for entry-level architecture students. Therefore, educators worked to transform the learning design of foundational ToD units by employing learning and assignment tasks based on design activism to enhance student engagement via immersive, hands-on technology education. This new learning design featured scenario- or project-based learning and assignment tasks and prepared students to gain essential competencies needed to take on their assignments, including the final exam, which is often considered the barrier to passing the first year.

Acquisition of these competencies entailed a hybrid of deductive and inductive reasoning, as conceptualized in the model of the six-course meal.

In the broadest sense, technology knowledge and skills play pivotal roles in shaping future job profiles for architecture. Currently, the acquisition of technological concepts relies heavily on teacher-centered lectures and tutorials that tend to treat students as passive recipients rather than interactive partners in the learning process (Ward, 1990). Although an interactive learning design is not widely used in architecture education, the existing literature strongly supports its ability to promote comprehension and retention of advanced technological concepts (Nooriafshar, 2007; Wickens, 1992; Paivio, 1986).

Additionally, broader opportunities of interactive technology learning have the potential to innovate learning and teaching practices across disciplines beyond architecture. Being the vehicle for physical manifestation of design thinking and learning, technology studies play a pivotal role in accredited architecture programs in which graduates are considered candidates on track for professional licensing. This factor is emphasized in the professional practice of architecture in which a firm grasp of ToD components is perceived as a clear indication of a student's job readiness and, therefore, his or her ability to excel in meeting the ever-changing technological demands of the job.

With regard to design education, the literature offers limited insights into the ability of design activism to influence student learning via application of key technology concepts to real-world scenarios. According to Prensky (2001), direct feedback from students demonstrates overwhelmingly positive results regarding the use of application-based approaches to teaching technology in physical, social, and cultural contexts. Furthermore, integration of professional competencies becomes easy when design practices integrate interactive human platforms to comprehend and convey complex technical concepts to their clients (Aldrich, 2004).

Although scenario-based design activism has proven effective when design is the focus in addressing basic civic and societal problems, its capacity in terms of issues such as the comprehension and appropriation of complex subjects, including technology, must be examined carefully. The underlying theory behind design activism revolves around the notion of knowing in practice, most of which is tacit for experienced practitioners but still unknown by students and other budding designers (Schön, 1983). The scenario- and project-based tasks inherent to design activism offer uninhibited platforms for students to contest their knowledge via action and gain know-how for coping with uncertain and complex content situations (Song & Lou, 2016). Such tasks also prompt content learning, whereas design activism approaches inform and activate people to participate in design-based interventions and to improve their present conditions in local and global communities (Seliger, 2014). Design activism also has the capacity to harness appeal and aptitude for learning tasks that can facilitate technology learning via application. It further offers ample opportunities to spot and reinforce strategic learning points as they appear, making them more accessible, effective, lasting, and replicable (Manzini, 2015). Design activism not only enables problem solving and makes sense but also encourages all forms of collaboration, multidisciplinary integration, and proactive intervention, which are essential in innovative learning (Margolin & Margolin, 2002; Manzini, 2015). Although still embryonic and somewhat uncharted, design activism potentially can influence the way in which students apply technological concepts that appeal to human goodness and wellbeing through supporting positive socioenvironmental change (Fuad-Luke, 2009; Lou, 2015; Manzini, 2015). The capability of this approach in helping students decode, analyses, synthesize, organize, and evaluate problems is linked closely to applied research because "no single individual can master this comprehensive background stock of knowledge" (Friedman, 2003, p. 511).

Approach

At Curtin University, which is located in Perth, Western Australia, not only is ToD one of the units with the highest enrolment numbers in the School of Built Environment (SoBE), but it also serves as the critical threshold for the retention of first-year students. Thus, ToD plays a pivotal role in securing and curating talent for successive semesters. In addition, the unit is the only foundational technology course common to both architecture and interior architecture, and as such, it demands an innovative range of didactic tools to engage students in interactive learning.

From the perspectives of both students and teachers, learning design involves the challenge of dealing with students with limited numeracy skills while providing them with a foundation on which they can continue to build their content knowledge and application in an immersive, hands-on manner (Ginsburg, 1998). Within a single unit such as this, it is neither possible nor desirable to cover the full range of technological competencies from principles of structural systems to building performance analysis required for beginning designers. Instead, the learning approach stimulated learners' cognitive faculties by offering them tools and techniques conducive to exploiting ethnological concepts in day-to-day practice. The design of the learning experience further helped students ask informed questions because they had the opportunity to encounter complex, scenario-based issues while completing sequential tasks leading to specific learning outcomes. The participatory aspects of hands-on learning, such as distinction, investigation, and application, enabled students to grasp technological concepts in a nonthreatening manner because they served to awaken students to the possibility of design that empowers—that is, design activism.

Because design activism only offers a platform of expression, a research tool was needed to facilitate the emergence of this learning approach. Therefore, instead of completing an assignment or product, students employed an action-research approach, which offers an uninhibited platform for works in progress (Brydon-Miller, Greenwood, & Maguire, 2003). According to Whyte (1991), action research synthesizes multimode learning and teaching desirable for foundational studies in technology, as reflected in some forms of participatory approach, action learning, praxis, colearning and design, collaborative inquiry, action inquiry, and cooperative inquiry (Lewin, 1946; Peters & Robinson, 1984). Action research also enables collaboration among tutors, unit coordinators, and students as stakeholders. The intent of this strategy is to clarify complex technology concepts using speculative explorations and unresolved questions. Design activism based on action research made scenario-centered technology learning a hands-on process by synchronizing learning and assignment tasks. In generating enlightened views via exciting discoveries, a theory–practice dialectics core to action research made the intervention particularly appealing to learners. This theory–practice dialectic further facilitated immersive and empirical learning essential to technology education in advanced leaning environments such as universities.

Intervention

End of semester student evaluations speak of a somewhat contradictory truth to their one-on-one feedback in the class, even though it may not be critically useful to address urgent issues of learning and teaching. In addition to mid-semester evaluations, students used an unmarked ballot box to deposit their comments on their weekly learning activities and teaching delivery. The transformed learning design, which was an evaluations-based response to students' lukewarm attitude towards content-heavy learning and assignment tasks, adapted a conceptualized French six-course meal as the impetus for learning innovation. Although a broad reference to a concept similar to the six-course meal design is not quite familiar, formulation of discrete learning palettes based on a scaffolded learning outcome is not an uncommon practice in innovative learning design. Particularly, innovation in the entry, operation, and conclusion of each assessment and learning task formed a cycle in this learning design, which took the form of sequential scenarios for learning by engagement, as is true of design activism. This intervention capitalized on the inherent ability of design activism educational approaches to provide hands-on, immersive yet controlled learning applications that target familiar and effective ways to engage foundation-level design students (Tversky, 2001). Redesigned tutorials and assignment tasks formed this educational six-course meal by means of professional practice workshops that constituted real-world scenarios purposefully choreographed for the application of cognitive, skill-based, technological concepts that replaced conventional memory testing of theories. Likewise, the scenario-based assignment tasks, including exams, took the six-course meal format with each course leading and feeding into the next, starting with an "hors d'oeuvres" of technology in a global context, which was followed by a focus on technology in a regional context and ultimately technology in the immediate context.

Course 1: Hors d'Oeuvres (the Stimulator— Technology in "Breaking News")

Concept. *Hors d'oeuvres* translates as "out of works." The "works" in this case refers to the main course of a six-course meal. *L'entrée* (the appetizer) is intended to stimulate the appetite and start the meal, acting as the palate preparation forerunner for an orchestrated sequence of taste scenarios. Unique to classic French cuisine, the ingredients and thus the term *entrer* (to enter) usually depend on the season and occasion. The first course does not simply stimulate the taste buds; it also refreshes the other senses for forthcoming courses.

Activism scenario. The ToD equivalent of the hors d'oeuvre was a focus on technology in a broader context. One example is how calamities of nature affect the built environment, an occurrence that often pops up in the news. Such scenarios would typically start with a grand tour question: What is going on in the world today?

Task. If the focus is on a distinction of environmental loads from live and dead loads, this task might present, for example, a recent climate extremity that was breaking news, especially because of its impact on the structural stability of the impacted buildings.

Example. Periodically, torrential rains and severe windstorms damage properties and lives in Queensland. Understanding of how environmental loads and resultant forces act upon buildings are critical to disaster resilient design.

a. Considering fluctuating nature of the environmental forces, identify a suitable classification system for environmental loads.
b. In an event of a similar disaster situation to that described above, indicate different types of environmental loads that can act upon a single-story residential building on a suitable architectural representation.

Course 2: The Fish Course (the Palate Teaser— Technology of Housekeeping)

Concept. The fish course comes between the starter and the protein (meat) courses and sometimes is garnished with vegetables. Usually, the palate teaser is followed by a dish of lemon or lime sorbet, which prepares the diner for the upcoming major calorie intake: the main course. The fish course thus offers glimpses of future courses or teases the palate, serving as a culinary bridge to the main course.

Activism scenario. The second scenario builds on everyday technologies, leading students to understand the measures needed to cope with local weather conditions as they affect one's own household or locale. This scenario could take into account the question: What's happening in your neck of the woods?

Task. A learning task for this scenario typically would require an awareness of the built structures in and around one's area of commute or neighborhood. In a typical task, students would be prompted to make structured observations of the built fabric in their surroundings that may or may not respond effectively to local weather conditions.

Example. Natural levees such as earth embankments with ground vegetation not only accommodate a change in the ground level without creating a slope but also resist and control surge damages in the event of heavy rain-related natural disasters.

a. Explain resultant forces and possible deformations to structures due to environmental loads.
b. Identify the human-made structure in Figure 1 also used to control surge damages.
c. Propose a way to drain ground water away from these structures, and briefly explain why such measures are necessary.
d. Propose a way to drain ground water away from these structures, and briefly explain why such measures are necessary.

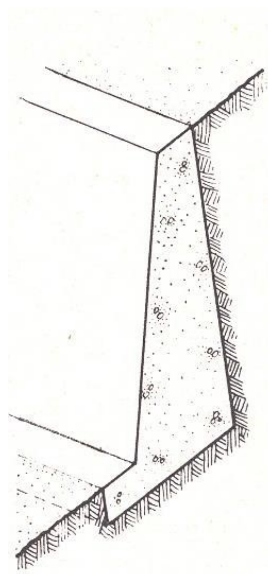

Figure 1. A typical retaining wall along earth embankments that prevent erosion yet allow surface drainage during heavy rains.

Course 3: The Main Course (the Palate Pleaser Technology of Makeup)

Concept. This course is the gastronomic culmination of the meal and includes an elaborate meat or poultry cuisine accompanied by a vegetable garnish. The garnish, mostly seasonal vegetables, may not appear on the plate but rather may be placed on the side. This side dish serves to make the main course more palatable by balancing protein with fibers and sometimes carbohydrates such as potatoes, couscous, or steamed rice. This course is designed to provide diners with a sense of dietary contentment, and it launches the gradual termination of the six courses.

Activism scenario. In the classroom, this course takes the form of a spontaneous launch into the epicenter of ToD: material appropriation for design. A typical scenario would ask a what's good here type of question.

Task. Application of content knowledge should test students' analytical skills in finding context-appropriate materials and assembly options. The below example demonstrates one of the tasks that could challenge learners to make the familiar unfamiliar by deconstructing known built structures in their locality into their (unfamiliar) constituents and then making these unfamiliar deconstructed parts familiar again by thinking of ways to put the building back together.

Example. Locally available materials and technology best understand potentials and constrains of context and equilibrium.

a. Identify the make or species of at least two locally available or manufactured construction materials widely seen in Perth residential constructions.
b. Draw an annotated section through a typical domestic masonry wall system with a concrete floor and a clay or concrete tile roof (using a specific scale is not required). Name each different element to clearly show clearly how:
    i. the roof structure is connected to the wall structure,
    ii. the wall structure is connected to the footing, and
    iii. rainwater and ground water are kept outside of the building.

Course 4: The Salad (Cleanser and Digestive Aid Physical and Technology of Character)

Concept. In a traditional French six-course meal, simple greens tossed with vinaigrette follow the main course to stimulate digestion. A complementary combination of ingredients and dressings works to cleanse and adjust the palate for the remaining courses, specifically the intensity of the cheese platter and the saccharinity of dessert.

Activism scenario. This scenario culminates in a deductive process, allowing students to explore the mechanical and physical properties of building material performance. A typical scenario would ask what the material feels like, causing learners to investigate the restrictions and potentials of materials that are locally manufactured, commonly used, and familiar from the previous scenario. This step enables learners to draw connections between materials and their performance in relation to their physical and mechanical properties.

Task. An ability to draw on technical properties is an integral part of decision-making and establishes a robust foundation for a rationalistic approach to design implementation. A typical task would involve a comparison and projection of structural possibilities for a range of commonly used construction materials based on their stress and strain probabilities.

Example. Based on physical and mechanical properties, the graph in Figure 2 offers an understanding of the way a particular material may respond to various structural and environmental loads.

a. Appropriately identify and label variables (X and Y) of the graph, and use the graph to build a relationship between the variables.

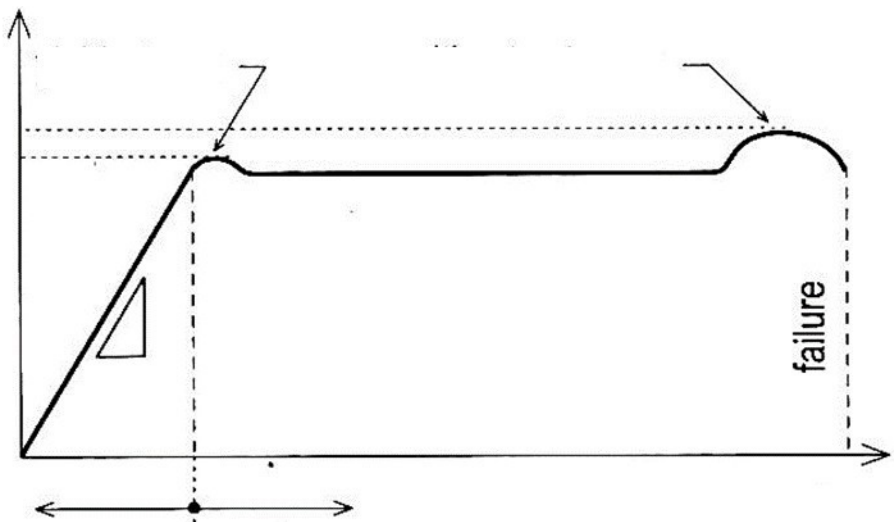

Figure 2. Metaphorically, clearing up a preconceived misconception behind performance of a material by introducing the relationship between its mechanical properties.

b. On the graph, indicate:
   i. plastic and elastic ranges and
   ii. yield and ultimate stresses.
c. If Figure 2 represent steel, indicate the relative positions of graphs for concrete and glass on Figure 2.

Course 5: The Cheese Plate (the Neutralizer Technology of Making)

Concept. This course comprises a myriad range of cheeses and plays the role of the neutralizer. This plate could appear before or after the salad or even replace the dessert. French chefs often prefer to let the cheese speak for itself; when complemented by specialty regional bread, the cheese platter neutralizes the acid left by previous courses and acts as the pre-dessert course. On some occasions, fruit and a few condiments may accompany the cheese platter. Although a formal meal proceeds to a desert course, the cheese plate typically signals the conclusion of the meal in regular, home-style dinning.

Activism scenario. This scenario exploits students' inquisitiveness stimulated by the process of making the familiar unfamiliar and vice versa during the previous course. This scenario allows learners to appropriate materials for a range of building assembly systems based on their ability to accommodate context and achieve equilibrium.

Task. The ability to draw on constructability is an indispensable component of the design decision-making process, and the purpose of this task is to establish a robust foundation in the rationalistic approach to design implementation. A typical task would involve a synthesis between the structural possibilities of commonly used construction materials and their practical implementation via rigorous 2D documentation using architectural details.

Example. A floor system is more than just a floor surface. It also includes all the construction on or in the ground or at an upper level of a building or structure that supports the floor surface. Elevated floor systems provide easy escape routes for ground water drainage, particularly in an event of floods.

a. Sketch and annotate typical detail of a steel-framed floor system complete with a hardwood floor finish for a small-scale residential project. The system should be supported on reinforced concrete stumps.
b. Identify at least two widely used floor framing systems in Western Australia.

Course 6: Dessert (the AftersTechnology of Tomorrow)

Concept. The French term *desservir*, meaning "to clean the table," marks the conclusion of the six-course meal. Indulgent, rich, well-presented desserts typically leave taste buds heightened in the process of digestion. Among a plethora of sweet desserts, often called "afters," sweet, savory, or sour delectable treats conclude the meal's fusion of different tastes. This portion of the meal usually is accented by a small demitasse of freshly brewed coffee or sweet wine. According to Krondl (2011), once the table is cleared of other dishes, desserts are presented as a *service à la russe* (presenting a meal in courses), which is a more recent adaptation of the *service à la française* (setting a variety of dishes on the table at the same time).

Activism scenario. This portion of the learning process brings the cyclical deductive and inductive processes of technology breakdown back to their grandeur: the technology of the future. A typical scenario would be the development of a broad discourse about what is going to be in the coming years using the familiar question: What's the future looking like?

Task. This task would foster students' ability to project and propose informed concepts for a future scenario through a set of data collected in the present. Supported by selected theories such as biomimicry and biophilia, students typically would systematically record active energy use in their own household to gain a tangible idea of carbon footprint creation and to extend such evidence-based ideas to future proofing of the built environment.

Example. Maintain a formal “use” diary related to your use of the place you live in. Choose from one of the following: the quantity of water you use inside and outside the place you live during 10 days or the quantity of energy you use in the place you live for water heating, refrigeration, lighting, cooking, and air-conditioning during 10 days.

When analyzing the diary results,

a. Establish where that water came from and what happens to the waste water in Perth. Further, establish how your usage compares with average usage for Perth and for at least one other city. How would you achieve net-zero water use?
b. If you have measured electricity use, establish where that electricity comes from and the greenhouse gases emitted from your use. Further, establish how your greenhouse gas emissions compare with the average emissions for Perth and average emissions for at least one other city. How would you achieve net-zero energy use?
c. Up to 35% of energy cost of a building is spent on artificial lighting. “Alight at night” is also a common phenomenon for most nonresidential buildings as they require cleaning, security, legibility (aesthetics), and safety as well as suffering from forgetfulness. If local and general lighting strategy can reduce energy cost and improve quality of space, then a building can influence nocturnal use as much as use during the day and maximize the benefits of the technology in the building.

Exercise. You will be assigned to examine future forward design strategies of a recently constructed on-campus building to evaluate its potentials for both diurnal and nocturnal use.

Conclusion

Backed by established teaching and learning concepts such as controlled guidance procedures, coaching, and leading the learner to exploit a familiar metaphor to learn a technological concept, scenario-based learning achieved increased student performance by reducing effort, inhibiting learning, and promoting long-term memory retention. Although inconclusive, exuberance in the classroom suggests that importance of further investigations into design activism’s ability to enhance the way that students seize key technological concepts via scenario-based learning tasks and the six-course meal exam design (Figure 3).

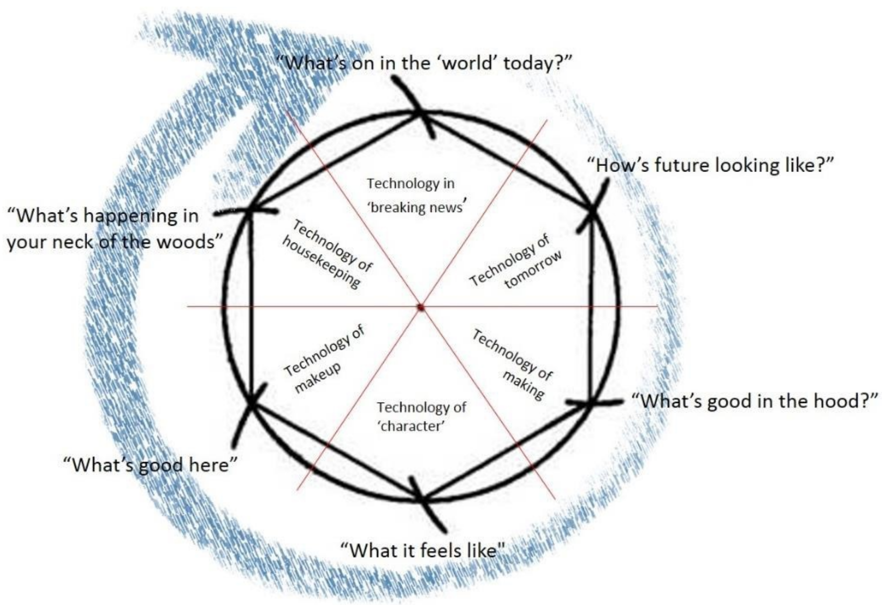

Figure 3**.** Scenarios and corresponding ToD concepts.

Design activism encouraged an understanding of unfamiliar technological concepts using familiar events of the present and investigation of the unfamiliar, allowing students to deconstruct the unfamiliar in such a way that it becomes familiar and can be applied to unfamiliar events of the future. Based on a six-course meal learning design, the processes of deduction (general to specific) and induction (specific to general) transformed linear technology education, making it a cyclical experience with multiple entry points. The transformation of the learning design tapped students with a range of competency levels and offered broadened options for multimode teaching and learning delivery. The inductive–deductive cycle further simplified the operational rationale of the ToD unit because one scenario fed reciprocally into the next, letting leaners travel back and forth between adjacent scenarios for both clarity and coherence.

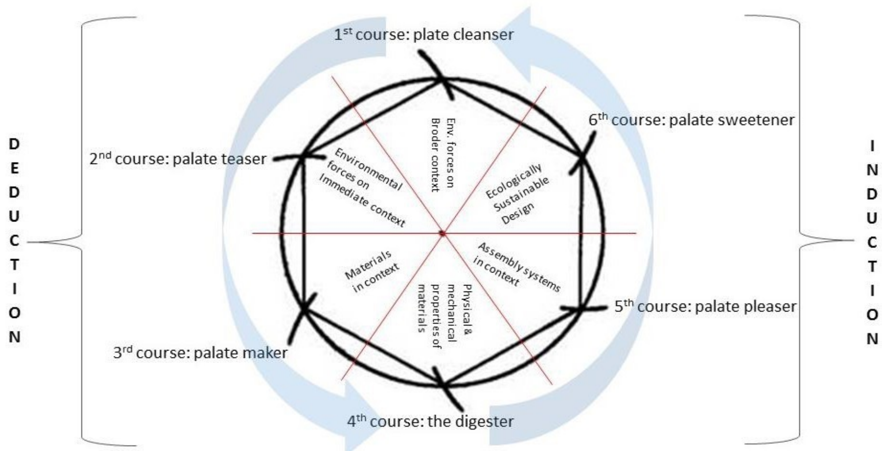

Figure 4. Deductive-inductive operational rationale of ToD.

The six-course meal learning design further transformed content-heavy technological concepts into activism-scenario-based learning and assessment tasks, particularly the final exam that introduced learners to complex structural, mechanical, and environmental concepts. The new learning design simulated real-world experiences in a deductive-to-inductive route via user-friendly interfaces and tools, such as familiar greetings during daily routines or mundane practices that led to the spontaneous elicitation of knowledge and skills. The finesse of formative learning outcomes such as artefacts, analytic drawings, and simulations also demonstrated the benefits of investing in learning design to increase the skill of learners in an effort to develop a professional path to job readiness. Although tutors and peers contribute greatly to the feedback experiences offered to the learners, a vertical integration must exist between facilitation and management to make the experience more valuable; an experienced faculty member would be needed at all phases of the operational circle. Strategic scenarios targeting distinction, investigation, and application not only established an internal logic for ToD but further facilitated multiple platforms for specialization by allowing students and teachers to learn together without taking on the entire task (Figure 5).

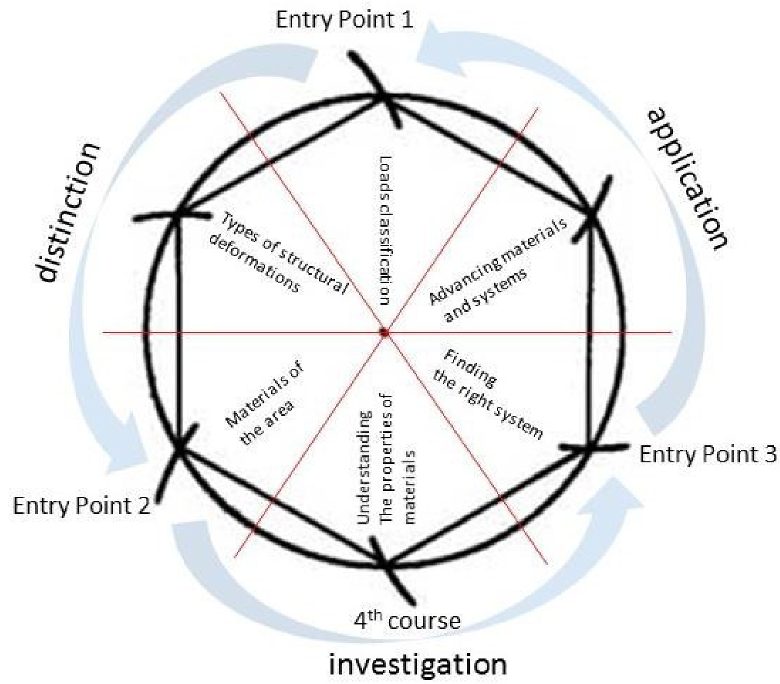

Figure 5. Internal logic of ToD phased through key concepts in foundational technology studies.

References

Aldrich, C. (2004). *Simulations and the future of learning: An innovative (and perhaps revolutionary) approach to e-learning*. San Francisco, CA: Pfeiffer.

Brydon-Miller, M., Greenwood, D., & Maguire, P. (2003). Why action research? *Action Research*, *1*(1), 9–28. doi:10.1177/14767503030011002

Friedman, K. (2003). Theory construction in design research: Criteria: approaches, and methods. *Design Studies*, *24*(6), 507–522. doi:10.1016/S0142-694X(03)00039-5

Fuad-Luke, A. (2009). *Design activism: Beautiful strangeness for a sustainable world*. London, England: Earthscan.

Ginsburg, L. (1998). Integrating technology into adult learning. In C. E. Hopey (Ed.), *Technology, basic skills, and adult education: Getting ready and moving forward* (Information Series No. 372, pp. 37–45). Columbus: ERIC Clearinghouse on Adult, Career, and Vocational Education, Center on Education and Training for Employment, College of Education, The Ohio State University.

Guy, S., & Farmer, G. (2001) Reinterpreting sustainable architecture: The place of technology. *Journal of Architectural Education*, *54*(3), 140–148. doi:10.1162/10464880152632451

Krondl, M. (2011). *Sweet invention: A history of dessert*. Chicago, IL: Chicago Review Press.

Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues*, *2*(4), 34–46. doi:10.1111/j.1540-4560.1946.tb02295.x

Lou, Y. (2015). Design activism in an era of transformation. 装饰 (*ZHUANGSHI*) [Chinese Journal of Design], 267, 17–19.

Manzini, E. (2015). *Design, when everybody designs: An introduction to design for social innovation*. Cambridge, MA: MIT Press.

Margolin, V., & Margolin, S. (2002). A "social model" of design: Issues of practice and research. *Design Issues*, *18*(4), 24–30. doi:10.1162/074793602320827406

Nooriafshar, M. (2007, January). *Virtual reality and 3D animation technologies in teaching quantitative subjects.* Paper presented at the 6th Annual Hawaii International Conference on Statistics, Mathematics and Related Fields, Honolulu, Hawaii.

Paivio, A. (1986). *Mental representations: A dual coding approach*. New York, NY: Oxford University Press.

Prensky, M. (2001). *Digital game-based learning*. New York, NY: McGraw-Hill.

Peters, M., & Robinson, V. (1984). The origins and status of action search. *Journal of Applied Behavioral Science*, *20*(2), 113–124. doi:10.1177/002188638402000203

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Seliger, M. (2014). Visual rhetoric in design activism. In *Tradition, transition, trajectories: Major or minor influences? 9th Conference of the International Committee for Design History and Design Studies* (pp. 599–604). São Paulo, Brazil: Blucher. doi:10.5151/despro-icdhs2014-0087

Song, D., & Lou, Y. (2016). Design activism: Action research as an approach when design meets social innovation. In W. S. Wong, Y. Kikuchi, & T. Lin (Eds.), *Making trans/national contemporary design history: 10th Conference of the International Committee for Design History & Design Studies* (pp. 284–290). São Paulo, Brazil: Blucher. doi:10.5151/despro-icdhs2016-03_018

Tversky, B. (2001). Spatial schemas in depictions. In M. Gattis (Ed.), *Spatial schemas and abstract thought* (pp. 79–112). Cambridge, MA: MIT Press.

Ward, A. (1990). Ideology, culture and the design studio. *Design Studies*, *11*(1), 10–16.

Wickens, C. D. (1992) *Virtual reality and education.* Paper presented at the 1992 IEEE International Conference on Systems, Man, and Cybernetics. doi:10.1109/ICSMC.1992.271688

Whyte, W. F. (Ed.). (1991). *Participatory action research*. Newbury Park, CA: Sage. doi:10.4135/9781412985383

About the Author

Chamila T. Subasinghe (chamila_sad@yahoo.com) is a Fulbright Fellow in Architecture at Curtin University, Perth, Australia.