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Typologies of design thinking: the learner-led perspectives

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Abstract. The research aims to offer critical discourse on various perspectives on design studio teaching pedagogy. The paper begins by exploring the generic literature that focuses on a range of instruments, approaches and actions; the tools that the designers deploy in order to steer specific thought process in design. By keeping the learners at the core, the subjectivity of designers brought to main focus here. Although there are many research works on studio environment and studio framework, only a very few focus on capturing evidences of the learners' creative thinking and this research is an attempt to fill this gap and keeps the learners at the core of analysis. The method was a theoretical exploration on various perspectives on design thinking and to obtain evidences of students' thinking. Two studios of Final Year studies of Part I, from University Malaya and Taylor's University, have been the case studies of the research. The paper first offers a critical discourse on identifying a gap in architectural design studios' teaching pedagogy and second offers a set of typologies of design thinking from the case studies. The findings were 8 typologies of design thinking which could be categorised into 3 groups, based the domain of the constructs. The research reinforces and determines the importance of learner-led teaching pedagogy for architecture design studios, by formulating typologies of design thinking.

Keywords: architectural education, design thinking, student-centred learning, typologies

1. Introduction

The research has its objective to offer critical discourse on various perspectives on design studio teaching pedagogy. The paper begins by exploring the generic literature that focuses on a range of instruments, approaches and actions, the tools that the designers deploy in order to steer specific



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thought process in design. By keeping the learners at the core, the subjectivity of designers brought to main focus here. This research takes a typological exploration of design thinking through evidence based research. The usefulness of such a research are a) to promote individualism and originality of design thinking, b) to offer to effective teaching pedagogy to empower the inner strength of the young designer/learner and c) to offer to the idea of learner centered teaching. The major research question is: What is the typology of thinking processes of a student in a studio environment?

The sub research questions are:

- a) what are the various stances of design thinking in the existing literature?
- b) are there any typologies of design thinking in a studio environment?

The methods were to explore theoretically on various perspectives on design thinking through literature review and to obtain evidences of students design thinking, through two design studios in University Malaya and Taylor's University. Whilst the former method answers the sub research questions a above; the latter captures evidence for the sub research question b, above.

2. Theoretical Discourses

2.1. Existing literature on design thinking

By so far the exploration and research done for and in the domain of design thinking fall into three main themes, namely, a) studio resources, b) teaching pedagogy and c) mediums of productivity. Firstly, the theme of studio resources considers the studio ambience and instructors. Ochsner (2000) stresses the interaction between the student and the instructor as crucial and identifies the 'shared play' as telling and listening and demonstrating and imitating. The findings of Attoe and Mugerauer (1991) through interviewing 20 award winning studio masters, effective studio teaching comprises of 14 factors parked under three categories, namely, the teacher as the self (4 categories), personal style (4 factors), course format (6 factors). Secondly, the theme on teaching pedagogy elaborates on the processes involved in design activity. Lawson (2005), mentions the stages of creative process (first sight, preparation, incubation, illumination and verification) and the types and styles of design thinking (behaviorist, the Gestalt school, cognitive science approach) considering the reasoning and imagining as important to designers. All these involve in and engage with the orderliness of thought processes. Carmona (2017) focuses on the tools of governance of design process, such as the context and the self. Rodgers & Winton describe (2010) processes such as inspiration, ideation and implementation; Ardington and Drury (2017) explore the direction on studio as context of learning and the discourse of guidance and feedback; Atlier project (2011) suggests designing as performing in which performance contributes interventionist, participative and experiential epistemology. Brown (2009) mentions design is act of changing a need to a demand or opportunity; stresses on divergent ways of looking into new choices and convergent ways for making that selected choices as an opportunity and possibility. Finally the medium of productivity such as drawings (Unwin, 2007), models and metaphors (Snodgrass & Coyne, 2013) and digital technology (Tepavčević, 2017).

Very few research works focus on capturing evidences of the learners' creative thinking. Snodgrass and Coyne (2013) explore the deeper interpretations and elaborates on three design thinking namely, play, edification and otherness. Chance (2010) emphasized architectural education builds skill in all areas of Kolb's (1984) (as sighted in Chance, 2010) decision-making cycle as shown in Figure 1. The cycle involves active experimentation, concrete experience, reflective observation, and abstract conceptualization. Architectural education requires students to use all of these modes of thinking. Most studio assignments require at least one full cycle, and each smaller decision benefits from holistic analysis as well. Chance (2010) proving that linear thinking just doesn't work for architects using Kolb's model. Kvan and Jia (2005) used Kolb's model to explore learning styles of architectural

students in China and correlates their learning styles with design studio performance. Their studies noted that assimilators succeeded by achieving higher grades than others in the design studio.

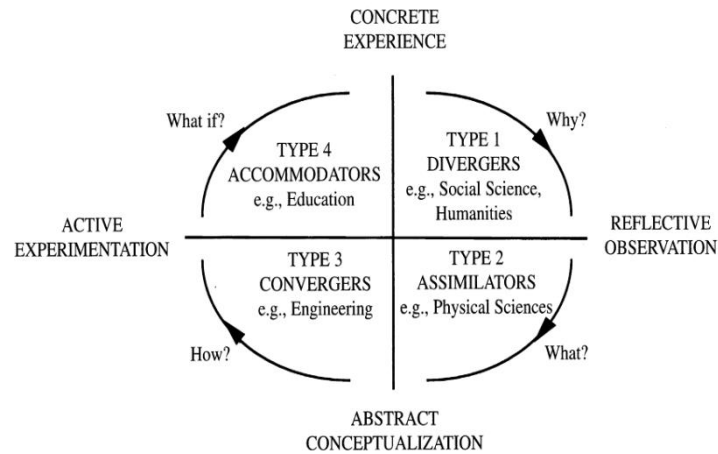


Figure 1. Learning styles and learning cycle based on Kolb's model (Chance, 2010).

The above literature review brings in the following issues:

- The external aspects such as studio environment, teachers and context of the course work are explored in detail, whereas the designer or the 'self' is given almost least exploration.
- The learners' background, choice of thinking, approach to architecture and possible originality of design thinking are not focused at all.
- It is widely understood that there is a gap on exploring the connections between process (resources and methods) and product (the final outcome), which is the designer/learner herself/himself.
- Lack of a studio method that actually empowers a student with originality of her/his own design thinking.

3. Case study

3.1. *Design Studio V (DSV), University Malaya*

Further to the pilot study conducted in Taylor's University during March to July 2018, the first case study was conducted in University Malaya, Design Studio V. This semester's design following the year's themes 'tourism + culture', the project was to propose a compact urban hotel for Kuala Terengganu. This new sub typology of accommodation that will be the first of its kind in city. The design proposal must take into account the definition of what is an urban compact hotel. The accommodation should provide a world-class compact hotel experience for visitors to Kuala Terengganu that offers a level of service and privacy within the tight space afforded by a small parcel of land. A new hotel building that will permit guests to enjoy the several unique urban garden settings, that also is be used to buffet the street noise.

The cohort of August to December June 2018, has just completed the Studio V project on the compact urban Hotel. The evidences show that the thought processes can be generalised and patterns of collectiveness are evident. Our initial preposition, of finding if there could be themes of design thinking, has proven to be positive at the outcome.

The typologies of design thinking were interesting; as below.

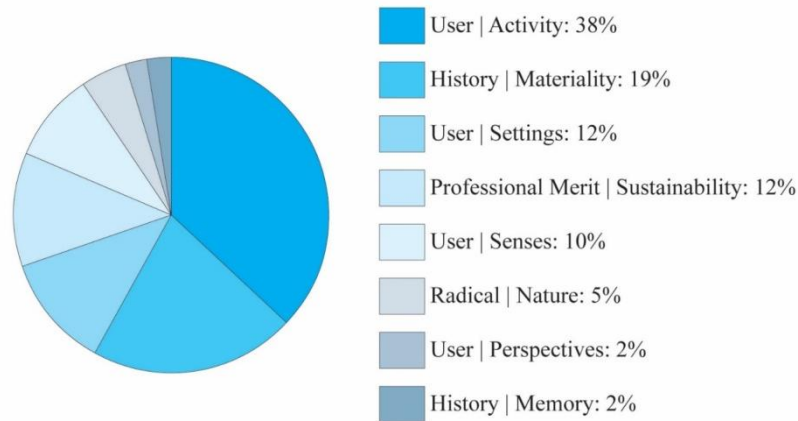


Figure 2. Typologies of design thinking: 42 studio-students from University Malaya.

The explorations within a typology varied in design intension and in consideration of design components. This can be explained as below, from the data collected:

User | Activity: The typology of ‘users | activity’ has had seen a building not only brings people together through culture and the arts, but it also functions as a nexus between the various streams of the city. The design considerations were: functionality, comfort (indoor climate, lighting), aesthetics (materials, shapes, details), the relationship with the context (social, cultural and physical), social facilities (spaces of interaction), fluency (ease of movement, universal design) and the environment which relate to the surroundings.

History | Materiality: The typology of ‘History | Materiality’ highlighted the difference between memories understood as a materiality versus a social or cultural fact. The design considerations were: Tranquillity, Social interactions, Greenery, Landscape, Eateries, Farming, History, Textile, Identity, Process, Abstraction, Sense of tradition, Structure, Technology, Story-telling, Lighting, Safety, Pattern, Local material used, Assembly, Performance, Shadow play, Angle, Movement, Human body, Façade, Historical context, construction materials, spaces, culture

Professional Merit | Sustainability: The typology of ‘Professional merit | sustainability’ was to create spaces in sustainable way is not only in the strict sense of implementing green technologies, but socially and culturally as well. The design considerations were Ecology, Green buffers, Public spaces, Green spaces, Open spaces, Greenery, Façade, Climatological, Ventilation, Shading, Façade pattern, Connectivity, Junctions, Safety, Traditional, Layout, Pattern, Farming, Trees, Recycle, Garden, Courtyard.

User | Settings: The typology of ‘User | settings’ encouraged different adaptations might include creating spaces that are green, encourage activity, or even promote social interaction. The design considerations were: image, Community, Accessibility, Engagement, Ease of recognition, Ventilation, Traditional, Layout, Pattern, Spatial arrangement, Boat craft, Spatial arrangement, Boat craft, Spatial sequence, Workspaces, Sense of place, Culture, Traditional character, Interactive, Circulation, Recreation



Figure 3. Sample of a University Malaya's student work under typology of User | Activity.

User | Senses: The typology of 'User | sense' had perceived the sources of senses such as sight, smell, hearing, and touch far above what is normal for the user's needs. Those tactile sensations are not just changing general orientation or putting people in a good mood, they have a specific tie to certain abstract meanings towards social, culture and digital media in future. The design considerations were: Visual, Adaptability, Shadow, Light, Human scale, Story-telling, Identity, Movement, Digital media, Sound, Senses, Smell, Pattern.

Radical | Nature: The typology of 'Radical | Nature' explained that design should be paid sufficient attention to the natural rhythms of human neurobiology can result in conscious joy. The design considerations were: Health, Nature, Art, Spatial sequence, Public spaces, Buffer zones, Connectivity, Blurring boundaries

User | Perspectives: The typology of ‘User | Perspective’ related to functional layout to space planning and works towards a functional layout should be more concern in safety, security and privacy which encourage social interaction. The design considerations were: Flexibility, Safety, Security, Privacy, Social interactions and views.

History | Memory: The typology of ‘History | Memory’ created a mutual understanding of the project and to build up ownership and roots in the local community. The design considerations were: Memorability, History, Technology, Structure.

3.2. Design Studio V, Taylor's University

The second case study has been conducted at Taylor’s Design Studio V of the B.Sc. (Hons) in Architecture. The studio focuses on urban context with corner block site for a Learning Centre typology; comprising of architectural strategy and design development. The major site issue being the fall of spatial connections and engagement to the local community, to the tides of various contemporary forces. The design of the proposed library is to consist of appropriate architectural responses that address aspects of the urban street, its context, and surrounding user behavioural patterns as discerned and analysed in the Preliminary Studies.

Table 1. Design Studio V Pedagogical chart.

| <i>Levels of knowledge</i> | <i>Pedagogy</i> | <i>Stage</i> | <i>Methods</i> |
|----------------------------|-----------------|-----------------------|---|
| Declarative | Collaborative | Analysis and research | Preliminary studies: Group project, Online discourses, precedent and urban studies |
| Procedural | PBL | Design and evaluation | Final project: Individual design explorations, design and design development |

The cohort of August to December 2018, has just completed the Studio V project on a learning Centre. Students’ domains of design thinking are captured through their process of work and the product of final design outcome at the stage of design development and detailing. During the project, the students were observed and provided with guidance that dignified their own opinions and ideas. The evidences show that the thought processes can be generalised and patterns of collectiveness are evident. Our initial preposition, of finding if there could be themes of design thinking, has proven to be positive at the outcome.

The typologies of design thinking were interesting; as below.

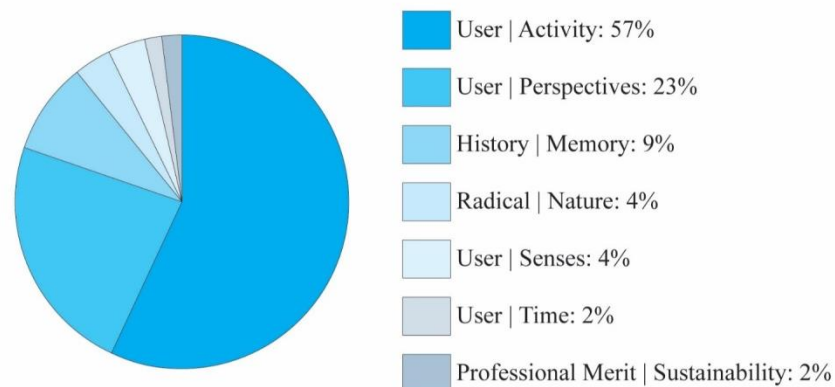


Figure 4. Typologies of design thinking: 56 studio-students from Taylor's University.

The explorations within a typology varied in design intension and in consideration of design components. This can be explained as below, from the data collected:

User | Activity: The typology of 'user | activity' was more concerned of everyday public activities to the periodic maintenance requirements as well as how the elements, zones and spaces are organised. There are different techniques students often use to explore and explain programme. The design considerations were: Community, functions, Social interaction, Adaptability, Story-telling, City image, Social experiences, Readability, Historical value, Privacy, Safety, Security, Human needs, Street connectivity, Street, Pedestrian. Human needs.

User | Perspectives: The typology of 'User | Perspective' establishes a link between the user and community, earning their trust, admiration as well as enhancing physical comfort and safety and security of neighbourhood. The design considerations were: Visual aspects, comfort, Sense of belonging, Places for exploration, Local attachment, Experiences, Social interaction, Movement, Human scale, Walkability, Privacy, Positive space, Greenery, Expression, Dynamism, Pattern, blurred boundaries, Building edges, Landmark, Permeability, , Circulation, Pedestrian, Connectivity, Network, Perception, Aesthetic, functions.



Figure 5. Sample of a Taylor's University student work under typology of User| Activity.

History | Memory: The typology of 'History | memory' refers to spaces that can be remembered, that we can imagine or hold in the mind as well as consideration. The design considerations were Cultural value, Healing, Social belonging, Memorability, Traditional, Experiences, Vernacular, Memory, History, Art, Craft, Identity, Community, Collaboration.

Radical | Nature: The typology of 'Radical | nature' offers the physical nature of the built environment an easier way to assume that the visual qualities of spaces dominate our perception of a building. The design considerations were Digital media, Nature, Technology, Interactive, Tradition, Greenery, Landscapes, Squares, Public spaces, Perception.

Professional Merit | Sustainability: The typology of 'Professional Merit | Sustainability' ensuring health lives and promoting well-being for all is important to building prosperous societies. Sustainability challenges the professional to contribute to sustainable communities and quality of life.

The design considerations were: Cycling, Environmental, Ventilation, Quality, Façade, Planting, Community

User | Senses: The typology of ‘User | senses’ provides an art form beyond its materiality, the less it is constrained by the natural world and the closest it is to pure spirit, the more elevated and transcendent it became. The design considerations were: Senses, Play, Music, Noise, Echo, Experiences.

User | Time: The typology of ‘user | Time’ concerned the buildings that develop very complex relationships to times. They are changed and even converted to other building types, which cuts them off from their networks even though they still occupy the same location. The design considerations were: Light, Shadow, Overlapping, Daylight, Active learning, day/night, weekday/weekend patterns.

3.3. *Design Studio V students from both case study universities*

In order to find constructs, which are deeper values of a student designer to engage with that particular typology of design thinking, a questionnaire survey was executed. It was online questionnaire survey open to the DSV students of both of the case study universities. The questions were open ended, in order to be led by the respondents rather than our design findings by so far in the project.

The findings from the Online Questionnaire Survey were surprising. Main finding was the initial proposition of finding whether there could be themes of design thinking or not, has proven to be positive at the outcome in the case studies chosen. The Typologies of Design Thinking as follows:

History | Materiality
History | Memory
User | Activity
User | Settings
Professional Merit | Sustainability
User | Perspectives
Radical | Nature
User | Economy
User | Senses

Secondly, it is also found that there are patterns between constructs and typologies (see Figure 18). The highest relevance of varied construct was evident when the typologies are about users – on activity (scenographics), settings (behavioural) and perspectives (formal/visual). The wealth of constructs is deep or a few when the typologies are about economic, sustainability, temporal and senses.

Thirdly, the significance is to offer tools for exploring originality in design and therefore to empower the young budding designers, the students of architecture. This finding will shed new light on learners’ centred studio pedagogy with an intent of empowering the young learners. It has also offered a deep discourse on a) positivistic (materiality, settings, activity), b) interpretative (perspective, senses, time) and c) critical (sustainability, economy) thinking on the process of design itself.

4. Overall Conclusion

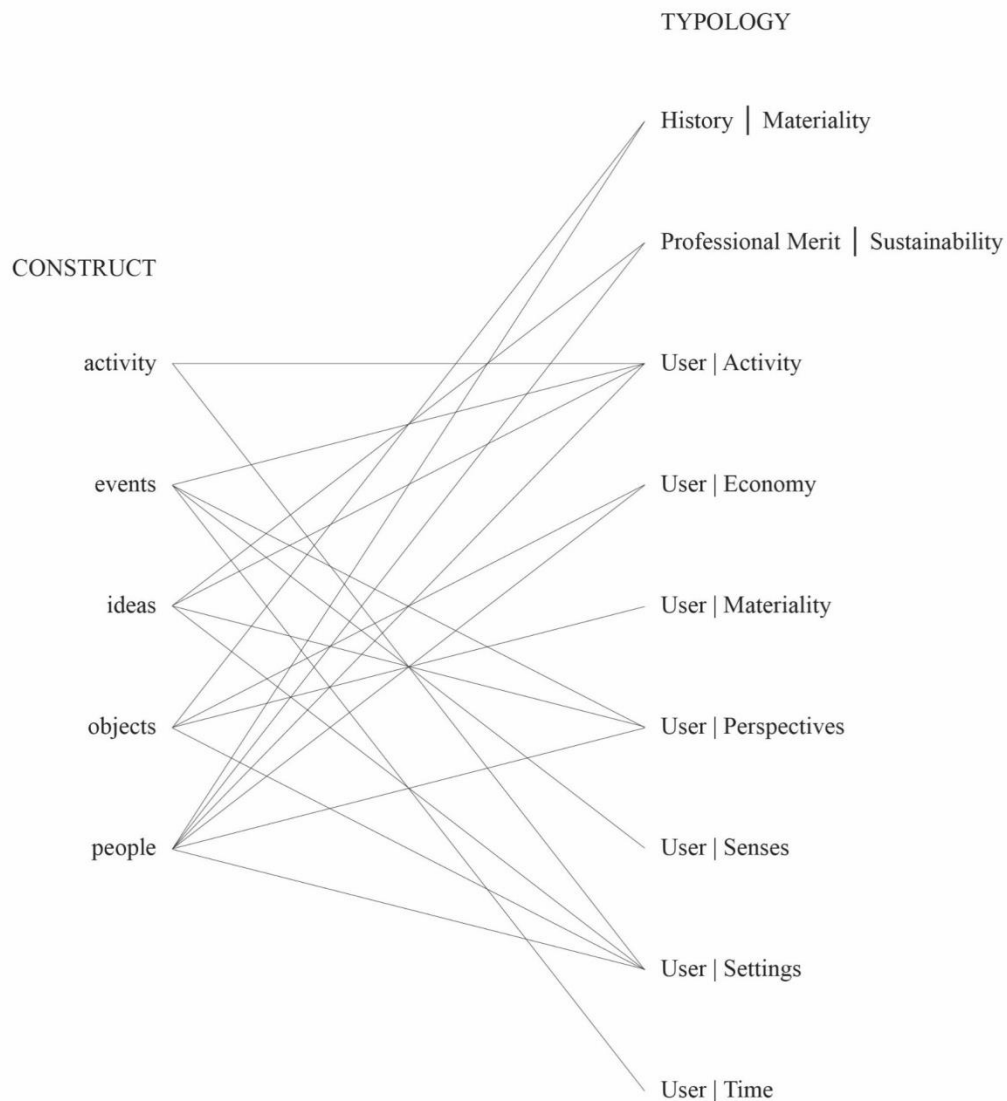


Figure 6. Constructs and typologies mapping.

Hard typologies: These formulate the typologies pertinent to the elements of design such as form, function, circulation. The constructs are usually about objects and ideas.

Soft typologies: These formulate the typologies pertinent to the intangible aspects of design such as concepts, principles and qualities. The constructs are usually about people.

In-between or the hard/soft typologies: These formulate the typologies pertinent to the middle ground of both extremes, such as the articulation of things to form a concept, scale, proportion etc. The constructs are usually about activity and events.

The future directions may be of two folds: a) recognising the field of psychology and b) pedagogy for design studios. The deeper co-relations of the constructs found in this research, leading to a

specific typology of design thinking, can be executed in the field of psychology. This could enrich architecture teaching pedagogy and the future scholars seeding in the primary or secondary schools.

The research began with an intension of understanding design thinking by the young minds. It was interesting and useful to know that there are typologies of design thinking and thus the given set of students can be taught in their own unique way, through reference materials, authors and inspirations. Typologies are generic principles that will help aid a pedagogy in the studios, without disregarding the specificity of each student designer.

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The students of the cohort of August to December 2019, of Design Studio V, of the B.Sc. Architecture, Architecture Department, Built Environment Faculty University of Malaya. The Studio is coordinated by Ms Ati Rosemary Mohd Ariffin and the instructors are Dr. Datin Norhayati Hussain, Mdm Norizan Abd Rahim, Dr Norafida Ab Ghafar, Ar Eddie Choi and Mr. Hiroyuki Sube.

References

- [1] Ardington, A., & Drury, H. (2017). Design studio discourse in architecture in Australia: The role of formative feedback in assessment. *Art, Design & Communication in Higher Education*, 16(2), 157-170. Atlier Project, 2011, 'Design things', Chapter 6: Designing as performing, MIT Press
- [2] Atlier Project, 2011, 'Design things', Chapter 6: Designing as performing, MIT Press
- [3] Attoe, W., & Mugerauer, R. (1991). Excellent studio teaching in architecture. *Studies in Higher Education*, 16(1), 41-50.
- [4] Brown, T. (2009). *Change by Design*, Harper Business.
- [5] Carmona, M. (2017). The formal and informal tools of design governance. *Journal of Urban Design*, 22(1), 1-36.
- [6] Chance, S. (2010). *Writing Architecture: The Role Of Process Journals In Architectural Education*.
- [7] Kvan, T., & Jia, Y. (2005). Students' learning styles and their correlation with performance in architectural design studio. *Design Studies*, 26(1), 19-34.
- [8] Lawson, Bryan (2005), *How Designers Think – the design process demystified*, Architectural Press, Oxford.
- [9] Ochsner, J. K. (2000). Behind the mask: a psychoanalytic perspective on interaction in the design studio. *Journal of Architectural Education*, 53(4), 194-206.
- [10] Rodgers, P. & Winton, E. (2010). *Design Thinking*, Conference proceedings on Engineering and Product design, Norwegian University, Norway
- [11] Snodgrass, A., & Coyne, R. (2013). *Interpretation in architecture: design as way of thinking*. Routledge.
- [12] Tepavčević, B. (2017). Design thinking models for architectural education. *The Journal of Public Space*, 2(3), 67-72.
- [13] Unwin, S. (2007), *Analysing architecture through drawing*, *Building Research & Information*, 35:1, 101-110