

ENHANCING STUDENT'S CREATIVITY IN ARCHITECTURAL DESIGN BY LEARNING FROM THE DESIGN COGNITIVE PROCESS OF A PROMINENT ARCHITECT

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ABSTRACT

Architecture is a professional discipline that integrates art and science to build attractive, practical and safe structures for human activities. In architecture, design is a core subject where students are taught the main skills to produce drawings and models of building design. Furthermore, architectural design involves a cognitive process that generates higher level of creativity in producing noble design solution. Such process is also fundamental to students who are learning architecture in the higher education. It helps student to develop their level of creativity and competency in design. This intellectual capability is an important aspect for architectural students to practice as professional architect when they graduated. Malaysia has many talented and internationally well-known professional architects. Their works represent high level of creativity that can be beneficial sources of practical knowledge to the students. Unfortunately, these respectable architects' creative cognitive processes are not properly documented for references to others within the architectural community. Therefore, this paper aims at exploring and identifying the cognitive process characteristics of a local prominent, visionary architect, Dato' Dr Ken Yeang who is well known for his creative, masterpiece architectural works. A semi-structured interview was conducted to gather insights on his cognitive process while designing to produce creative solution for complex architectural problems. The study found that this professional architect has a distinct formulation of knowledge, skills, attributes and principles that he utilises while designing and looking for creative solutions. This dynamic, integrated process involves imagination (intrinsic) and modelling(extrinsic) capabilities that produce renowned local architectural buildings. Such significant cognitive attributes will be useful guides to improve creativity in design among the young architectural students.

Keywords: *cognitive process, creativity, education, designing, experience.*

INTRODUCTION

Nowadays, many countries are competing for a more advance technologies that will enhance the lives and activities of their people. Some of these activities include social, economic, health and education. With the aid of the advance technologies especially digital, people in various professions can work more efficient and productive. For example, architects can produce faster, better 2D, 3D illustrations and construction drawings with advance digital tools like AutoCAD, Sketch Up and other digital applications. Such applications can generate various and multiple design schemes for an architect's ease of pursuing design solutions. Nevertheless, their roles to improve creativity of architects and architectural students is questionable. There is a possible

tendency that digital tools may weaken critical thinking aspects of the cognitive process. This is because it minimises the application of manual, hands-on design skills as an important 'learning by doing' process to enhance creativity in design.

Several studies by Lawson (2006) and Schon (1992), indicated that creativity requires a dynamic cognitive process that integrates thinking, conceptualising, making and demonstrating to generate design solutions. This process involves two designing capabilities that are imagination (intrinsic) and modelling (extrinsic). Imagination deals with virtual, internalization for thinking while modelling deals with manual, hands-on for making. Therefore, acquiring high level of creativity requires one to undergo a process known as 'learning by doing' through virtual and manual capabilities. In architectural education, a student begins as a novice designer. After series of 'learning by doing' process, they will become a competent designer. Later, through experiences as a working practitioner, he or she becomes an expert with vast pool of experiential knowledge. As a result, he or she can be a prominent architect due to his or her landmark buildings with creative design solutions. This is considered essential as part of integral architectural learning process that requires students to acquire a well-balanced theoretical and practical knowledge. Prominent professional architects are good exemplary sources for such knowledge which are currently limited to the students.

Therefore, the aim of this paper is to explore the important features in the cognitive process of a well-known architect who has profound creativity and design expertise. By doing so, this research will be able to gather meaningful insights that can contribute toward improving the learning experiences among young, novice architectural students.

LITERATURE REVIEW

A proper understanding on the nature of design cognitive process is essential. Therefore, this will allow a researcher to explore possible key features that contributes to the high-level creativity. Such features are considered as beneficial to prominent architect for producing novel, inventive design solutions to various complex architectural building project. In addition, it is also meaningful to look into the distinct way of learning architectural design that takes place in the design studio environment. Such learning involves the integration between imagination (internalization) and practicality (externalization) simultaneously. It is a vital part of learning that develop learners' and students' design competency and creativity in producing architectural design solutions.

Cognitive Process

Generally, cognitive processing is described as series of cognitive actions that generate the creation and manipulation of mental representations of information. This process may involve attention, perception, reasoning, emoting, learning, synthesizing, rearrangement and manipulation of stored information, memory storage, retrieval, and metacognition (Krch, 2011; Wolf, 2014). It can occur in the state of conscious (learning a concept) or unconscious (learning a skill). Moreover, such occurrence can be activated internally, to recall a memory or externally, to solve a problem by sensory input from the environment.

Initially, this cognitive process is seen as temporal, sequence process. Later, contemporary views look at this process as a more dynamic, non-linear, cyclical process. The contemporary views are closely related to the cognitive process that involves architectural

design thinking and learning. This is because architectural design deals with complex, ill-defined project that involves ideation, prototyping, testing, evaluation of proposed solutions that are done repeatedly until they are accepted as the finest solutions.

According to Pressman (2018), design thinking is a very influential process that facilitates understanding and framing of architectural design problem. It enables architects, designers and young students to generate creative solutions that can provide fresh perspectives on our physical and social living environment. For professional architects, design thinking can be applied to solve numerous real-world problems and resolve dilemmas in our built environment. Design thinking is a tool that may generate inspiration and the imagination. Subsequently, these lead toward creative, innovative ideas that are responsive to the needs and problems of the people.

Creativity

Creativity occurs through a cognitive process when a person uses his/her ability (mental and physical) to generate ideas, solutions or products that are novel, practical and valuable. Some researchers also define creativity as that which 'produce(s) work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints). Therefore, the degree of creativeness of product/solution/process can be accessed on the basis of the 'novelty' and 'usefulness' of these product/solution/process, where usefulness represents the value of products (Schendurnikar, 2019).

Creativity are closely related with designing activities. Architecture is one of the disciplines that largely involve with such activities. Design is not only concern with objects or 'products' (extrinsic qualities), it is also involved 'process' (intrinsic qualities). Designing involves the parallel lines of thoughts (Lawson, 1993) that highly activate the response between the two hemispheres of the brain. The active interactions between the left and right side of the brain allow a person to perform a particular task in an integrative and constructive manner (Tovey, 1984). In such instances, he or she become an active thinker or learner who is able to generate and express ideas effectively through verbal and visual communication modes (Cross, 1990).

According to Runco and Acar (2012), creative thinking is described as the ability for designers who also include architectural students, to use their creativity in making meaningful concepts, questions, and theories, experiment with various options. This also gives them the opportunity to compare their own work with their peers' ideas, final products and processes (Zbašnik-Senegačnik & Kuzman, 2014). By doing so, students are able to identify, emulate and learn variety of creative design solutions among their peers. This also suggests that it is important for these students to develop design knowledge and practice which can enhance their ability to articulate and generate higher creativity. Consequently, they accomplish a broader and deeper imaginative thinking through collaborative peer learning. In short, Zbašnik-Senegačnik & Kuzman (2014) stated that to think creatively, one must first have the skills to think creatively to be actively engaged with their designer's learning community.

Learning by Doing

In the design studio environment students practice, experience and learn the process of designing architectural artifacts (Lawson, 2012). These become the core activities in their

architectural education. They are ‘learning by doing’ to integrate the theoretical and practical design knowledge to produce potential design. It is a constructive, generative learning process where they develop and present design ideas and solutions. They were verbal and visual representations that include sketches, drawings, models and also computer-aided graphics.

The basis idea of ‘learning by doing’ is partly originated from the curriculum at the Bauhaus design school. It was structurally balanced between the ‘practical instruction’ and ‘formal instruction’ (Crimson & Lubbock, 1994). This structure supported architectural students in their learning by doing with other practices particular those involve in arts and crafts. The presence of other disciplines will enhance architectural students’ technical experiences as well as their creativity and learning personalities by means of self-discovery (Farghaly, 2006). In addition, it allows discovery, self-regulated and hands-on learning by means of collaborative and interdisciplinary practices. As a result, architectural students gained mastery in certain technical skills in several disciplines.

Architectural design studios foster the ways of knowing and doing needed for discovery, integration, application, and sharing of knowledge between designers especially, students and their experienced design tutors (Lackney, 1999). These learning activities are part of the integral, complex and distinct process of learning architectural design from a novice toward an expert level.

Design Experience and Expertise

Creativity is a combination of having richness in experience and expertise to be able of producing extraordinary ideas (Wolf, 2014). Similar to expertise, a specialist is described as someone who "has, includes, or demonstrates unique expertise or information obtained from training or experience" (Merriam-Webster, 2020). Therefore, it is very useful to study the design experiences and expert practices possessed by well-known architects. These will involve their way of applying skills, principles and techniques of practising, problem solving and learning by doing. The study will also look into a variety activity of cognitive processes such as memory constructions, key generators, guidance and reasoning biases (Hoffman, 1998). These experiences, whether they are positives or negatives, will shape an architect’s design mind and behaviour into becoming experts in their profession.

Those characteristics can be observed on a well-known architect, Kenzo Tange, a Japanese great architect. He was a member of the Japanese think-tank that established the metabolism doctrine (Xue & Xiao, 2014). With its innovative and imaginative urban and architectural projects aimed at a sustainable world, the movement attracted the attention of the international architect group in the 1960s (Lin, 2007). Before unveiling the ideology, Kenzo Tange and his party of architects and other professionals conducted many trials and surveys. This Metabolism principle would not have been formulated or visualised without the feedback and experience of people from diverse backgrounds and fields.

Santiago Calatrava, a Spanish architect, is another example of a prominent, expert architect who has designed a number of distinctive and recognisable buildings, structures. Many of them which drew influence from various facets of life, including human figures, natural imagination, and material and property experimentation. This indicates that in order to reach this degree of concept thought, one must be innovative and have well-formed ideas. Santiago, as a structural engineer, embodies an exploratory venture into aesthetical facets of

structures to the extremes rather than implementing ordinary, less creative structural solution (Shendurnikar, 2019).

Dato' Dr Ken Yeang is an internationally well-known, prominent architect who is considered as the pride of Malaysia. He possesses many resemblances of high-level creativity as the two previous prominent architects described earlier. Many of his local and international buildings have been well known and received iconic status. Among those buildings that received multiple awards and recognitions are The Roof Roof House, Menara Mesiniaga Tower and DiGi Technical Office (The Edge, 2011). For this reason, Dr Ken Yeang was chosen as the main subject of this research investigation.

METHODOLOGY

This research adopts qualitative approach by doing semi-structured interview. It is more meaningful to gather naturalistic insights (Nassaji, 2020) on the experiences of a person going through series of design cognitive events. It allows the researcher to identify significant underlying unique features of creative design process. These features are manifested through profound design solutions in the form of sketches, illustrations and models. By doing so, one can emphasize the process and pattern of development creative process in relationships to the product or outcome of the process. Due to this process of exploring ideas on a particular event, this study has chosen a prominent architect, Dato' Dr Ken Yeang. As mention earlier, he was chosen because of his vast architectural experiences, well-known buildings and high level of creativity.

In this investigation, developing the key questions is important to guide the process of interview. The questions are as follows:

- i. What are the significant creative process features of the prominent Malaysian architects such as Dato' Dr Ken Yeang?
- ii. How these profound creative features can act as general guiding principles to enhance creativity and among young, novice architectural learners.

From the above key questions, several key inquiries were generated from the literatures that involve design process and works from other well-known architects. These inquiries emerge from the similarities in practices and knowledge that are identified among those architects in the literature study. The purpose of these inquiries is to understand better on the creativity that take place in the cognitive process of this particular architect.

Therefore, the first inquiry is the architect's inspiration. Secondly, the architect's ability to manipulate various skill. Thirdly, his formulation of design guiding principles. Lastly, the use of instruments and tools to demonstrate ideas. These inquiries will be beneficial to identify attributes that influence his high degree of creativity.

Once the inquiries were obtained, the next stage of investigation was the face to face interview with the selected prominent architect. The audio interview was then transcribed into words format. Finally, the inductive analysis process was conducted to identify the significant underlying features as they were manifested or externalised. The findings of those unique features will be discussed in the following section.

RESULTS AND DISCUSSIONS

From the analysis of interview data, there are several interesting, meaningful features that emerge from the cognitive process of Dato' Dr Ken Yeang while he is designing. Such features are considered very influential to his dynamic design thinking that generates highly creative architectural design solutions to a complex building project. His ideas have richness and well-balanced of advance theoretical, practical and experiential knowledge. These can be utilized in the integrated state of unconscious (internal) and conscious (external) process from imagination to reality. His creative ability in organizing, manipulating and transforming indicates his mastery in architectural design. The followings are discussions on those key design cognitive features of Dato' Dr Ken Yeang.

Sources of Knowledge and Inspirations

“There’s learning art...When I reach the end of my secondary education I met a few architects. I met my uncle who was an architect. I met Sua McLaren, Mr Lim, Peter Lim. He’s a very nice man. Sua came and visit my father and mother because his father is my father’s close friend. So he’s an architect, Sua McLaren...I was influenced. So, I think I’d like to become an architect. Then, I started first year in AA because my uncle also went to AA so I thought it’s a good school” (Dato' Dr Ken Yeang).

Those utterances indicate that Dato' has develop his interest in architecture when he was learning art in his early education at school. His interest in architecture was further reinforced when he met many of his father’s friends who were architects. Later, he decided to pursue his dream to be an architect and he successfully graduated from a highly respected architectural school in the United Kingdom.

Those descriptions show the importance of early exposure of art and skill that can shape one’s mind and motivation in architecture. Having doing so, one begins to explore and discover more about architecture. Such explorations are further enhanced when one’s is guided by a person who is considered as a role model with architectural expertise (Wolf, 2014). There are many inspirations that one’s can gain from a role model, especially, when one wants to be an architect.

Therefore, early exposure, role model for inspiration and proper learning atmosphere are considered vital in learning architectural design. The early formation of design cognitive ability and design skill can be instilled among young students through formal instruction and also informal interaction with people (Crimson & Lubbock, 1994). This informal learning exposure is considered useful as part of self-regulated, active learning in architectural education (Farghaly, 2006).

Formulating Guiding Principles

It is a dream for every graduating architect so have their own signature in every building that they design. For example, a famous architect Frank Lloyd Wright’s the Falling Water where he design the building blends with nature by following his own Guiding principles which are one of them are “character is natural” which portray as Poetic tranquillity instead of a more deadly “efficiency,” should be the consequence in the art of Building: concordant, sane, exuberant, and appropriate to use. Having something as a reference will guide the designer on

to what limits can he/she cannot go beyond so that the design will have a harmony outcome (Toker, 2007). This research found out our chosen prominent architect Dato' Dr Ken Yeang's key guiding principle is **design economics** that ties his decision in making the design. As he says below:

"We start with the financial model. So let me see your financial model. By the time we do the financial model for X development. We make decision on what types of buildings, how many square footage, your parking equipment, the facing, the service price, construction cost, so X development too much, I say let me show you our model, so that became our finished design base. So the financial model became our design base." (Dato' Dr Ken Yeang).

"Then we diagram it. We diagram the building option. Financial model become the programme" (Dato' Dr Ken Yeang).

After knowing how much the client is willing to spend on the project/design, then comes his second guiding principle **the function and practicality** of the design. Where Dato' Dr Ken Yeang will come up with his design based on these two mentions guiding principles mentioned earlier:

"The client show us their model, we'll do it for you. We do it 1 page version. I can show it to you. So once you do the financial model before we start actually doing the schematic design, I look at different building options. Ok, 2 towers, 1 tower, 30 storey towers with podium, 40 storey towers with no podium, or shopping mall, we look at different design or building form options. Sometimes about 4 to 5" (Dato' Dr Ken Yeang).

Dato Dr Ken Yeang enjoy to give creative design option to his client to choose the best solution that suits his/her needs requirements for the project That is where his third guiding principle is **options**. As he said below:

"... I say we took 1 week, 3 to 4 days X development option out. I'll show it to you later. Then the client says this is what I like. When this is designed and then we'll do different aesthetic options. How does X development cost, this & this, 2-3 options. Once inside the design options, then we finish the schematic design we can go build already" (Dato' Dr Ken Yeang).

It is important that designer/architectural student have options in their design solution. This gives them opportunity to work faster without proposing new solution but at the same time they two options summarizing a solution that they can combine or integrate to create another possible solution.

Ability to Manipulate Imagination and Practical Skills

Dato Dr Ken Yeang uses the advantage of his vast experience on top of his basic knowledge in architecture to create interesting proposal. His projects usually requires him to think novel ideas and create new scheme to fulfil the client's brief and also offer something different to the already saturated architectural market and demand.

The skills that he developed along the years whether it is practical or digital has able him to manipulate imagination based on the information that he gain while developing design

whether through the information provided by client, background studies or site analysis. As demonstrated below:

“This is the project we designed in Gyeonggi, Korea. This is the master plan. So, within the master plan we try to design habitats. Habitats for certain species alive. So, compare this with the master plan. It’s the same master plan so the red means different habitat. Habitats of number mangroves, number roofs, site that we planted, then the density of the areas. So, these are the green area on the ground. So, these are different habitat. Then we do native species that we want to bring. So, these are different species which are hazardous to human being. Species like rats and snakes. Then from there we try to verify the flora or track the fauna then we match the species with the habitats. So, whether it’s for feeding, breeding or refuge. Once we match this; we call this biodiversity matrix. Then the next stage is to try to create the actual landscape conditions to enable the species to survive over the four seasons of the year because Korea we have cold, very cold winter, summer, very nice season to me. Then there is a greater fusion of organic life of the empirical life. So, it’s not simple doing this” (Dato’ Dr Ken Yeang).

The information in his possession will trigger his creative side to propose interesting ideas which will benefit the client, end user as well as the society adjacent to the project in which he manifest it using his practical skill in visualising the intangible ideas into a tangible form that could be understood by a common people.

According to Philip N. (1988), “creativity constitutes a compromise between knowledge and freeing oneself of that knowledge”. Hence, before integrating the information into their design process, architects must first grasp the principles of design. When they advance in their careers, they become more familiar with words and architectural jargon:

(iii) Gaining expertise through practice and pool of knowledge

“There’s this carbon neutral design you know....We can design the carbon neutral building but it’ll be very high in building energy. So, how to achieve a carbon neutral building with low building energy. Still haven’t been resolved because the more technology you put in, the more it is low carbon emission but imported energy in the system is very high. So, disaster issues and there’s aesthetic issues on what does green building actually look like. So I’m trying to figure out the issues of applications and to me, the truly green building we don’t even have... it’ll be very, very expensive. We don’t have the budget to do. So there’s a lot of issues to be resolved. The green building is to me only a process. The real icon thing maybe the next 5 years or so. Now, you go out to town, every architect tell you they green design” (Dato’ Dr Ken Yeang).

Zainal & hasim (2019) described decision-making as the process of recognising, selecting, and analysing the best solution, scenarios, and concepts. The above utterances resemble those descriptions. Furthermore, it also illustrates the profound cognitive process of Dato’ while dealing with the complexity of a building design needs and requirements. His design expertise with accumulated practical experiences and pool of advanced knowledge enables Dato’ to resolve practical and aesthetic issues that can save budget and at the same time, it is sustainable. Later after 5 years, his ideas and solutions based on green and ecological architecture becomes prominent and inspirations for many architects.

This is an exemplary design ability that demonstrates Dato’ high –level of design creativity that is ahead of time and his peer architects. His iconic architectural style transforms through exposure with time and futuristic demands. Subsequently, he developed his own

personal design philosophy and approach in relationship to context, resources and technology (Billett, 2013; Maranzano et al, 2005; Schwartz, 2012).

As part of architectural learning process, it is essential that young designers and students to develop their design maturity, expertise through multiple series of design process and development. Architectural design deals with ill-informed design problems in which the searching of design solutions need the width and depth of precedent and experiential knowledge. Moreover, design process seeking for creative solution is a dynamic, non-linear process which requires them be participative with design peers (Lackney, 1990). It gives them opportunity to cultivate innovative, creative ideas while sharing pool of knowledge among their peers. As a result, they accumulate additional experience and competency in architectural design to be more creative

CONCLUSION

Creativity in architectural design is the key indicator of student's proficiency in design ability. It is the ability to manipulate, translating and transforming internal, external design input of a complex design problems into an innovative, creative, and promising design solutions. One effective way of improving such creativity among young students is by exposing them the design thinking and practices of the well-known professional architects. This will guide them better by integrating with the available current knowledge toward becoming a good architectural designer.

Therefore, this study reveals meaningful design cognitive features that are possessed by the prominent architects. These features are very useful for the architect to generate innovative, creative design solutions to an ill-defined, complex architectural building projects. Among the features are the ability to utilise multiple skills and imaginations, experiential and abundance pool of knowledge, mastery and expertise in design approach. Due to these highly creative features, this architect receives global recognition for their iconic, exemplary buildings.

Besides the formal knowledge from design studio environment, young students can gain valuable informal knowledge from the way the prominent architects use their novel creativity to contribute outstanding building designs for the people.

In the future, more prominent architects will be interviewed to gather more insights on their creative design cognitive process. Hopefully, it can further enrich the learning experiences of the young architectural students who one day will be the new generation of architects in the future.

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