

CONCEPTUALISATION IN ARCHITECTURAL DESIGN PROCESS AT
UNIVERSITI TEKNOLOGI MALAYSIA

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To our prophet, *Muhammad s.a.w*, the messenger of Truth,

To my dears *father, mother, husband, sons, Mother-in-law, Father-in-law,*
siblings and in-laws

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ABSTRACT

This research investigates conceptualisation as a process of giving meaning to a design problem in a bachelor of architecture program. As design always starts with vague and half-formed ideas, sketching is conducted to clarify the ideas and to generate new ones. Thus, sketching allows for student's reasoning of design through problem solving and critical thinking. However, in the reality of studio learning the student's capability in thinking about design is shallow and uncertain. This occurs as resulted from an ill-defined nature of design problems as well as a failure of students in carrying design from one stage to another. Therefore, this study aims to identify how students conceptualise their design ideas in the design process as part of studio learning. Three factors which are (i) framing problem, (ii) evaluating moves and (iii) reflecting design influencing the conceptualisation process in the architecture design studio, which deal with the reflection in action between the students and their design process in the studio learning. Using the framework of Schon's Reflective Learning in tackling a design problem, the research employed a case study of six third-year architecture students of Universiti Teknologi Malaysia, Johor Bahru to understand the conceptualisation process. The selection of the students was based on the purposive sampling technique. Data were elicited using two methods: (1) observations of students' sketches and (2) description of students' interviews on studio reflections from three design stages of the initial design, refinement design and the final stage of the architectural drawing software. Data were analysed using content analysis by segmenting and coding of the raw data of the students' sketches. A total of 191 sketches were identified in the study that involved ten design activities. The research reveals that 36.6% of the students' sketches were produced during the initial design stage, 45.5% of the sketches during the refinement design stage, and 17.8% of the sketches during the final stage. The finding suggests that the differences in students' sketches were constructed from the logical relationships of the design elements, analytical strategies and creative thoughts of the students. Students also exercised four methods in developing their understanding in design; (i) revising precedents, (ii) visualising images, (iii) form-making design, and (iv) developing space planning. Consistently, through segmentation of entities and making order of sketches, the research suggests that the conceptualisation process has aided the students' thinking in identifying and evolving design ideas. Overall, the study emphasises that Universiti Teknologi Malaysia architecture students reasoning about design is influenced by many aspects as it involves the adaptation of metaphors, analogies, precedents, self-preferences of the preferred events, functions, forms and meanings.

ABSTRAK

Kajian ini mengkaji pembangunan konsep sebagai proses yang memberikan makna kepada pemindahan masalah reka bentuk dalam program sarjana muda seni bina. Proses mereka bentuk selalunya bermula secara tidak jelas dan bersifat tidak lengkap, dengan itu lakaran diperlukan untuk memperincikan idea dan menjana idea baru. Dengan itu, lakaran membolehkan pelajar mereka bentuk melalui penyelesaian masalah dan pemikiran kritikal. Walau bagaimanapun, dalam realiti pembelajaran studio, keupayaan pelajar dalam membangunkan konsep adalah cetek dan tidak menentu. Ini berlaku hasil daripada permasalahan reka bentuk yang bersifat tidak jelas serta kegagalan pelajar dalam mereka bentuk dari satu peringkat ke peringkat yang lain. Oleh itu, kajian ini bertujuan untuk mengenal pasti bagaimana pelajar membangunkan konsep dalam proses mereka bentuk sebagai sebahagian dari pembelajaran studio. Adalah didapati tiga faktor iaitu (i) merangka permasalahan, (ii) mengatur gerak kerja dan (iii) menilai reka bentuk mempengaruhi proses pembangunan konsep dalam studio reka bentuk seni bina, yang melibatkan tindakan refleksi di antara pelajar dengan proses mereka bentuk dalam pembelajaran studio. Menggunakan kerangka Schon iaitu pembelajaran reflektif dalam menangani masalah mereka bentuk, penyelidikan ini melibatkan kajian kes terhadap enam pelajar senibina tahun ketiga di Universiti Teknologi Malaysia, Johor Bahru untuk memahami proses pembentukan konsep. Pemilihan pelajar adalah berdasarkan teknik persampelan bertujuan. Data telah diambil menggunakan dua kaedah: (1) pemerhatian terhadap lakaran pelajar dan (2) temubual pelajar mengenai refleksi aktiviti mereka bentuk dari tiga peringkat mereka bentuk iaitu reka bentuk awal, pembaikan reka bentuk dan peringkat akhir perisian lukisan seni bina. Data dianalisis dengan menggunakan analisis kandungan dengan membahagikan dan pengekodan data mentah lakaran pelajar. Sebanyak 191 lakaran telah dikenal pasti yang melibatkan sepuluh aktiviti mereka bentuk. Kajian mendapati bahawa 36.6% daripada lakaran pelajar telah dihasilkan semasa peringkat awal, 45.5% lakaran dihasilkan semasa peringkat pembaikan mereka bentuk, dan 17.8% adalah di peringkat akhir. Dapatan kajian menunjukkan bahawa perbezaan dalam lakaran pelajar adalah berdasarkan dari hubungan logik daripada elemen-elemen reka bentuk, strategi analisis dan pemikiran kreatif pelajar. Pelajar juga menggunakan empat kaedah dalam membangunkan pemahaman dalam mereka bentuk; (i) menyemak contoh projek, (ii) menggambarkan imej, (iii) membangunkan reka bentuk, dan (iv) membangunkan perancangan ruwang. Secara konsisten, melalui pengelasan entiti dan menyusun atur lakaran, kajian menunjukkan bahawa proses pembangunan konsep telah membantu pemikiran pelajar dalam mengenal pasti dan mengembangkan idea rekabentuk. Keseluruhannya, kajian ini menekankan bahawa pembangunan konsep oleh pelajar senibina Universiti Teknologi Malaysia dipengaruhi oleh banyak aspek yang melibatkan penyesuaian metafora, analogi, contoh projek, kecenderungan kepada pilihan situasi, fungsi, bentuk dan pengertian.

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LIST OF ABBREVIATIONS

CAEM	-	Council of Architecture Education Malaysia
CLOs	-	Course Learning Outcomes
Crit	-	Design critique in the studio-based learning
DS	-	Diploma students
ELT	-	Experiential Learning Theory
EMT	-	Episodic Memories Theory
LAM	-	Board of Architects Malaysia
MOE	-	Ministry of Education
MS	-	Mainstream students
PAM	-	Malaysian Institute of Architects
PLOs	-	Programme Learning Outcomes
RLT	-	Reflective Learning Theory
RIBA	-	Royal Institute of British Architects
RO	-	Research Objective
RQ	-	Research Question
UTM	-	Universiti Teknologi Malaysia

LIST OF TERMINOLOGIES

- | | | |
|--------------------------|---|---|
| Analogy | - | It is the ability to perceive and use relational similarity between two situations, objects or events properties. |
| Conceptualisation design | - | The process of giving meaning to a design problem by generating and evaluating design to help the students to define the concept abstractly into something that intentional and logic. |
| Design conversation | - | It is refers to the reflective interactions among designers or architects at their workplace, activities or situations in order to understand problems, to get ideas about solutions and to solve the design problems. |
| Design critique | - | It is a process of displaying and confronting ideas with the studio masters, clients or peers. |
| Design experience | - | It refers to a direct participation of students in events or activities which utilises their own understanding of experience, observation and reflection. |
| Design iteration | - | It is a process of carrying design that involved repetition of the tasks or actions in order to improve the design ideas or product. |
| Design knowledge | - | The knowledge of designers with a unique ways of knowing, understanding and applying ideas in solving a design problem. It is a blending knowledge of experiences, knowledge in action, and exploration of what should be or means to do design or the setting of values. |
| Design precedents | - | It is refers to the references or sources taken by the students to validate their design ideas or concepts. Normally, in the studio learning the design precedents referred to the previous or existing design projects by the architects or organisations. |

Design sketches	-	Is the output produces by the students or designers along their design process. Design sketches mostly about the ideas, events or processes that externalise on paper in the forms of written statements, abstract signs, bubble diagrams, maps, iconic images, and solid models.
Design studio learning	-	It is a pedagogic tool and a platform to enable experiential learning by means of active engagement with the environment. In design school, it refers to a classroom that resemble a workplace of designers.
Designer	-	It is refers to an experienced user in design knowledge, theories and application, advanced approaches and strategies who are dealing with more complex ways of doing things in designing and solving a design problem.
Diploma student	-	It is refers to the students who enrolled to the architecture programme by using their diploma studies. The diploma students have three year of studio experiences, mostly have an excellent skills in the technical application.
Mainstream student	-	It is refers to the students who enrolled to the architecture programme directly from the matriculation centre programme or those with higher school qualification such as STPM or STAM.
Novice student / design student	-	It referred to the design student who are new to the design system, its nature and knowledge who has tendency to use a simple design approach, quick reasoning and little extension of knowledge in performing design task.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Architectural education, as one of the most distinctive branches of education, requires creative capabilities (Salama, 1995). These distinctions involved with the balance between formal and socio-behavioral aspects as well as the balance between the students' faculties of searching, thinking and other mental activities. That is why, in architectural education, central discussions were focused on approaches in teaching methods, diversities of curriculum and learning methods, professionalism and practice, the knowledge of architectural design thinking and design activities of the architect. Despite the considerable differences in the architectural learning process, there is one significant similarity, whereas the design studio become the main forum of creative exploration, interaction and assimilation (Salama, 1995). This architectural learning system was introduced in the 1890s in the Beaux-Arts school in Paris. Since then, most independently run design studios across the world have emphasised the design studio approach.

In the design studio learning environment, design always started with vague and half-formed ideas. Therefore, sketching is conducted to clarify these existing ideas as to generate new ones (Fish and Scrivener, 1990). Through sketching, it allows the students to arise from the need to foresee the results of synthesis and manipulation of objects to help the students to define the concept abstractly into something that intentional and logical (Fish and Scrivener, 1990; Goel, 1995). In this manner, sketching become the language of thought used by students to define the

design process. Continuously, through sketching, it aids students for further acts of exploring ideas, expressing thoughts, generating alternatives, evaluating moves, and making actions (Johnson et. al, 2009, Do and Gross, 2001).

Due to the involvement of many variables and uncertainties in design ideas, approaches and limitless number of solutions, the nature of design studio is categorised as a wicked and ill-defined problem (Rittel and Weber, 1973; Head, 2010; Balassiano, 2011). Thus, this complex design nature make the design process is a tough job to be completed both for the students and designers. For instance, Casakin and Kreitler (2011) addressed the studio learning environment always follow with creativity. Creativity is defined as a mental process that leads to the development of unique and novel theories, ideas, solutions, or products (Reber, 1989). However, creativity involves wide variables range from emotions to physiological and psychological challenges. Examples of creativity that characterise the students in the studio learning involves describing the characteristics of objects found in the existing environment, such as shapes, structures, metaphors, and sensory qualities, as well as exploring the personal-subjective meaning of user's preferences in seeing things within his or her environment (Casakin and Kreitler, 2011).

Besides, design always emerges as wicked problem that have design processes and approaches that hard to be explained. Thus, in the past three decades, there have been an increased number of studies on the design process as an operation in its own right (Marda, 1996; Gero, 1998a, 1998b; Oxman, 1999; 2004; Gero and Fujii, 2000; Casakin & Kreitler, 2011). These studies were focused on the understanding of design process, challenges and complexities of design faced by designers and students, however, most attention concentrated on the actions and strategies executed by the designers. For instance, the studies involved; types of sketches and symbol systems, actualised cognitive processes and design activities executed by the architects in solving a design problem, designer's conversations and relations to design movements, as well as the role of creativity to the designer's performances.

Considering design studio learning environment is the main platform for students to learn about design, it is crucial to understand and to study the student's

activities and design processes from their perspective. As the design thinking approaches uses multiple ways of acquiring knowledge, such thinking, feeling, reasoning, and intuiting (Melles, 2008), it is believed that the students have undergone the same design processes as much as designers. Thus, this study concerns about the student's conceptualisation in identifying as well as solving the design problem in their studio learning environment.

1.2 Problem Statement

The design process of studio learning environment offers an experiential-based learning that emphasises hands-on experiences and direct engagements with design activities (Garrot, 1983; Kolb, 1984; Harris, 2004). This learning by doing has been found to maximise students' abilities in understanding design problems by leading them to reflect on the components of the design process (Schon, 1983; 1984; Schon, 1992; Schon and Wiggins, 1992). Menezes and Lawson (2006) also noted that direct engagements with the design process and environments provides a link to design theories and practices in a sequential actions of precedents, schemata and gambits. Besides, through iteration of design, these direct experiences gives students access to knowledge acquisition (Kolb, 1984), manipulation of design activities (Goldschmidt, 1991), development of student's design thinking (Peppler and Kafal, 2010) as well as recognition of abstract symbols or sketches (Fish and Scrivener, 1991; Goel, 1995; Lawson and Loke, 1997). This indicates that the design studio environment of the design processes and activities has become the formative platform to mold the student's understanding about the core of the architecture education (Gur, 2010; Batuman and Altay, 2014).

However, in the reality of studio learning environment, the student's capability in reasoning and identifying the problems is uncertain, that results for inconsistency of information in carrying design from one stage to another (Khaidzir, 2014). For instance, students were overlooked the useful information gathered from the design briefing and site inventory stage while exploring new things during the ideation stage. In the previous studies, Gick and Holyak (1980) and Beveridge and

Parkins (1987) addresses this situation as difficulties in spontaneously incorporating design information they have just acquired. In addition, Gobert (1999) addresses this situation of failure to link information from one stage to another as being related to a lack of spatial memory that led to students' approaches and strategies. This failure of students in recalling and recognising the previous activities or precedents, has caused interruptions in the chunks of information (Lawson, 2005b). Lawson (2005b) and Menezes and Lawson (2006) believed that in order to produce good design processes, the students need to follow the framework of constructing precedents, developing schemata and applying gambits. In cognitive science of information processes, studies shows that conceptualising routes not only crucial in the wayfindings of human on the physical attachments such as in urban spaces, it also crucial in the spatial relations and chunking of route directions to knowledge in the learning processes (Denis, 1997; Richter and Klippel, 2005; Klippel, Richter and Hansen, 2009, Zhang, Zherdeva and Ekstrom, 2014).

In other literatures, scholars confirmed that diverse interpretations, entities and meanings in design also contributed confusion among students while interpreting and revising their design sketches (Goldschmidt, 1991; Suwa and Tversky, 2001). These interruptions of student's reasoning in the design process of studio learning environment is due to the student's lack of design knowledge and experiences (Gero, 1999; Menezes and Lawson, 2006). The student's limitation in design knowledge and experiences has caused the reasoning process of identifying problems and solving solutions become a tough job to be completed.

Considering the problem of student's reasoning is due to student's lack of design knowledge and experiences, this study aimed to identify how the students conceptualised their design problem and ideas in the design process of studio learning environment. It is believed that by thinking of the problem, it allow student's reasoning as that promotes the student's problem solving and critical thinking on the phenomenon being studied. Therefore, this study is concerns on the student's conceptualisation of how the students reasoning of the design problem, conceptualising ideas as well as developing design solutions. In the previous study, Dorst (2004) emphasised that it is important to understand the ways students frame their design problems, as each student approaches is far different from one another as

from the designers. As much, Roozenburg and Cross (1991) noted that there are three models exhibited by the designers as well as students during the design process. The models involves on how the students perceive design problem, how they treat the problem, and how the design process has influenced to the overall learning.

Therefore, it is anticipated that in order to understand the student's conceptualisation and their reasoning process in the design process, the assessment of design activities, design outcomes or understanding should be done in person. This is primarily caused by their lack of design knowledge, which results in differences in architectural approaches and strategies. It also infers that students will always struggle with design when they have little knowledge and few design experiences. Therefore, the ways students tackle problems are as varied as their responses to their limited access to knowledge (Cross, 1990, 2006; Lawson, 2004b). The overall framework of problem statement is illustrated in Figure 1.1.

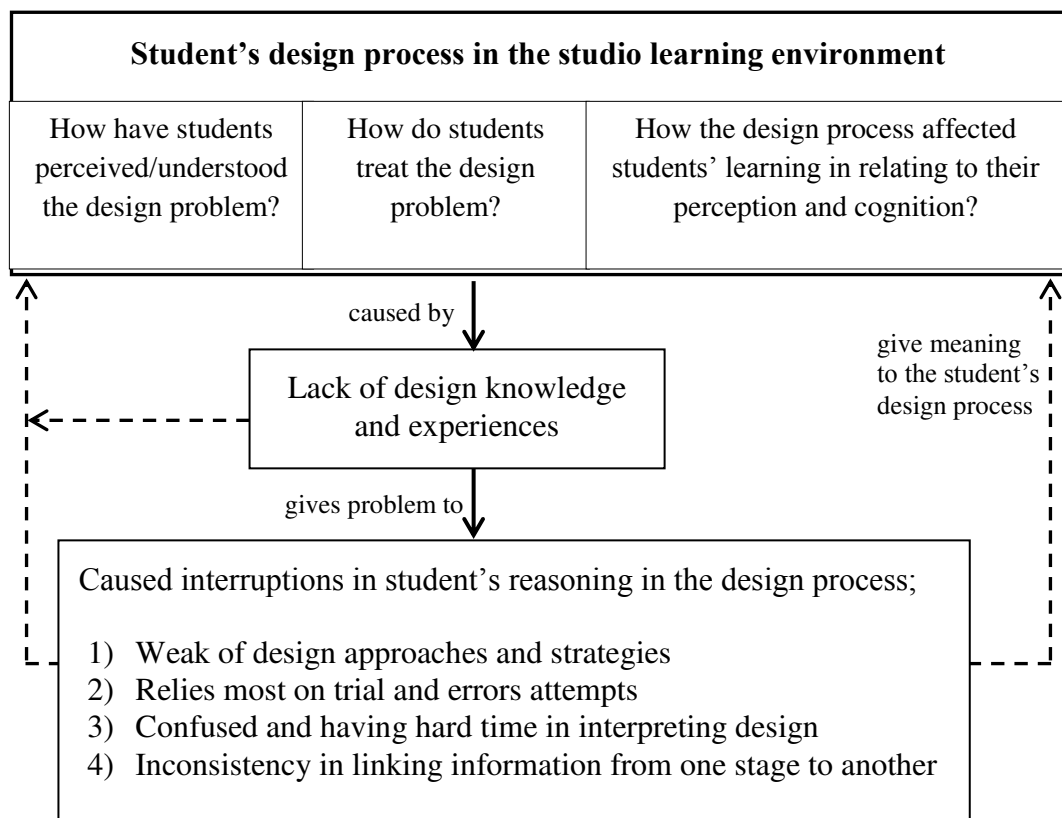


Figure 1.1: Framework of problem statement on the model of student's design process in the studio learning environment

1.2.1 The Need to Study Conceptualisation in the Local Context

In Malaysia, the number of institutions offering architecture studies is increasing. As a result, the number of architecture students is also increasing. There are seven public institutions, seven of private institutions, five of polytechnic centres, and six of Kolej Mara institutions that offered architectural courses in Malaysia. The figures for institutions offering architecture studies are illustrated in Table 1.1. This increasing number of institutions suggests that a considerable high number of students who are also involved in the design process of studio learning environment. With the nature of wicked problems and their' limitations in incorporating design from one stage to another, design process becomes very challenging. That shows a need to study and understand their conceptualisation of design in order to help these architecture students to complete their design task successfully.

Table 1.1: Institutions that offer architectural courses in Malaysia

Type of institutions	Description of Institution	Level of studies
Public (7)	UTM, USM, UiTM, UIAM, UPM, UKM, UM	Bachelor of Science Bachelor degree and diploma in UTM and UiTM
Private (7)	Taylor's, UCSI, IUKL, UTAR, Limkokwing, ALFA, Twintech College	Bachelor of Science and Diploma
Politeknik (5)	Poli. Ungku Omar (PUO) Poli. Sultan Haji Ahmad Shah, Pahang (SAS) Poli. Sultan Abd. Halim Muadzam Shah, Kedah (MAS) Poli. Port Dickson (PPD) Poli. Sabak Bernam (PSB)	Diploma
Kolej Mara (6)	KKTM Pasir Mas	Diploma
	IKM TSYA Pekan IKM Alor Setar IKM Sungai Petani IKM Lumut IKM Kota Kinabalu	Sijil

Sources: MoE (2015), Politeknik (2014), MARA (2014)

In addition, Table 1.2 illustrates the distribution of marks according to the designed tasks, course and programme learning outcomes of the third year architecture programme in the Faculty of Built Environment, Universiti Teknologi Malaysia. Task 1 of project brief development comprises of background study, site inventory analysis and building program accumulated of 20% of marks. Task 2 of ideation and design development accumulated of 50% of marks. Task 3 that emphasises on construction of technical design accumulated of 30% of marks. These marks distribution indicates that major concentration in the design course is focused on task 2 of ideation and design development stage. According to the programme learning outcomes (PLOs), three factors are prioritised in the architectural programme which are the problem solving, skills and architectural knowledge. In terms of course learning outcomes (CLOs), the student's achievement are assessed in four aspects; knowledge, critical thinking and problem solving, skills and communication, whereas three of the aspects gives the highest percentages as much as in the programme learning outcomes. As illustrates in Table 1.3, 60% prioritises on critical thinking and problem solving, 20% for the skills, 15% for the architectural knowledge while 5% for participation and communication.

Overall, the information in Table 1.2 and 1.3 informs that architectural knowledge in designing and solving design problem is crucial, as failure of students in incorporating information from one stage to another may possibly caused them to have problem in perceive critical thinking and problem solving skill. This may affect to their design approaches and strategies in identifying and solving problems. Thus, it is essential to identify how the students understand the problems and continuously perceived their ideas in the design process of studio learning. Recognising this may assist and benefit the educators in order to understand the student's conceptualisation in the design process of studio learning environment and to find possible ways to help them in the future.

Table 1.2: Distribution of marks according to tasks, CLOs and PLOs for third year architecture programme, Semester 1, 2014/2015, Faculty of Built Environment, Universiti Teknologi Malaysia

			Knowledge	Skills	Problem solving	Communication	Teamworking	Lifelong learning	Ethics and humanity	Leadership	Entrepreneurship
Program learning outcomes			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
Task	CLOs	Mark %									
Task 1: <i>Project Brief Development</i>	CLO1	20	10								
	CLO2				5						
	CLO4						5				
Task 2: <i>Ideation and Design Development</i>	CLO1	50	5								
	CLO2			20	15				5		
	CLO3						5				
Task 3: <i>Technical Design and Technology Integration</i>	CLO2	30	5	5	5						
	CLO3				10	5					
Total		100	20	25	35	10	5		5		

Source: Faculty of Built Environment (2014)

Table 1.3: Percentages of students' achievement according to course learning outcomes and design tasks

	Task1	Task2	Task3	Total % of CLOs
CLO1: Knowledge	10	5	-	15
CLO2: CTPS	5	40	15	60
CLO3: Skills	-	5	15	20
CLO4: Communication	5	-	-	5
TOTAL	20	50	30	

Source: Faculty of Built Environment (2014)

1.3 Research Gap

A review of at least 100 articles on design studies suggests that there are three groups of disciplines involved in research concerning the architectural design. These disciplines involve: (a) environmental studies, (b) pedagogy of learning and instruction, and (c) design cognition (refer Figure 1.2). The examples of studies that frame the theoretical gap for the study is illustrates in Table 1.4.

From the literature, it can be deduced that Malaysian researchers have concentrated mostly on the disciplines of environmental behaviour and pedagogical approaches. In term of environmental behaviour studies, for instance, it mostly discusses on the user's perceptual and behavioural responses to the environmental issues relating to design criteria, standards and implementation and impacts. Among examples, Tazilan et al. (2006) emphasised on Malaysian standard of public toilet design, while Said (2009) and Said et al. (2005) concentrated on designing garden and landscape design for the Malaysian hospital. Other studies such as Sahimi (2012) focused on designing an ideal preschool centre according to the children's preferences on the school environment, while Yatiman et al. (2013) investigated on affordances of primary school during their homeschool journey. These kind of studies more focused on relationship of user-environments and ways to enhance it.

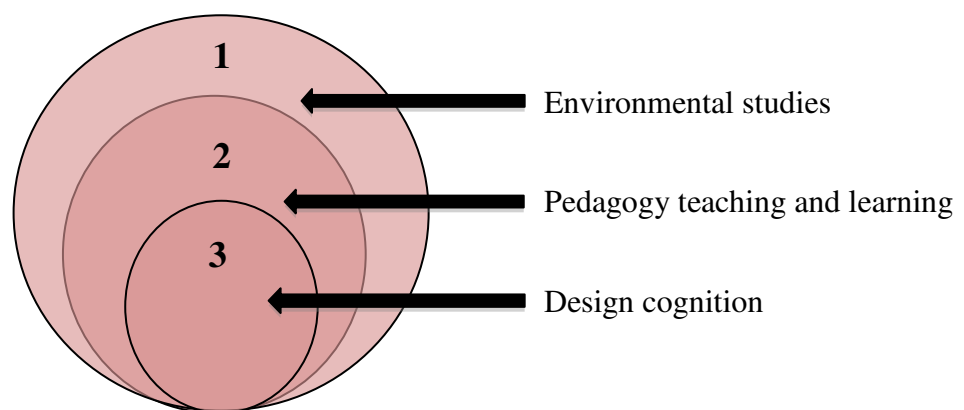


Figure 1.2: Categorisation of studies on the research concerning architectural design relating to three groups of disciplines

In contrast, the next discipline of pedagogy in teaching and learning concentrated on the studies relates to the user-environments in the architectural education. For instance, Darus et al. (2007), Hushin & Rahim (2010), and Hassanpour et al. (2011) investigated of the students perceptions on the mechanism of teaching and learning in studio. Other studies were focused on the evaluation of the studio critique assessment and facilities (Ayob et al., 2011; Utaberta et al., 2011; 2012; 2013). Baqutayan and Mai (2011) investigated on students' ways of coping strategies in handling stress in the design process. Besides, Zeeda (2001), Shari and Jaafar (2005; 2006), Surat et al. (2011) and Rao and Arbi (2012) highlighted on the education for sustainable issue and design curriculum in the architectural education in Malaysia.

There are other studies that focused on the core element of design, regarding of how the students think, draw and learn about the design process. At a glance, this kind of study is falls under the architectural education, however, it is rare to be found in Malaysia perspective. This is because most of the existing studies in the country were focused on the environmental behaviour and the ways to improve the architectural education in terms of design curriculum and syllabuses, studio facilities and teaching and learning methods. The realm of design activities and processes are not widely explored in Malaysia perspective, especially on the architecture students in their design process of studio learning environment. Therefore, this study aimed to explore the student's conceptualisation in identifying and evolving ideas which relate to the third discipline. The third discipline is design cognition concerning the architectural thinking and creative thoughts that involves knowledge structures of design process and reasoning system.

In the global perspective, there are growing interest focusing on the studies of design cognition, whereas little to be found in the Malaysian context. Indeed, the existing studies were more focused on the designers rather than the students themselves. For instance, Lawson (1994; 2004a; 2004b; 2005), Menezes and Lawson (2006), Lawson and Dorst (2009), and Suwa and Tversky (1996; 2002) were concentrated on how the designers think about design and perceived of their sketches. Studies by Goldschmidt (1991), Purcell and Gero (1998), and Suwa et al. (2006) were focused on types of sketches, design motives and meanings in

designers' sketches. Besides, the studies by Casakin and Goldschmidt (1999), Goldschmidt (1992; 2001; 2003), Casakin (2004; 2007; 2010), and Casakin and Kreitler (2011) investigated on analogies and metaphors as strategies evolved by designers in solving design problems that extended their creativity in design. Above all, only Suwa et al. (1998), Kavakli and Gero (2001; 2003), Kavakli et al. (2006), and Ahmed et al. (2003) investigated the relationship between sketching and cognitive activities by comparing distinction between the designers and students when it comes to tackling design problems (refer Table 1.4).

Comparatively, in the local context there were only two studies focused on design cognition. The first study emphasised on cognitive interactions between tutors and students in the design process of studio learning (Khaidzir and Lawson, 2012). The next study focused on the relationship of conceptual architectural sketches to the application of visual 3D interface using an architectural drawing software (Rahimian and Ibrahim, 2010). The other two studies were only a pilot study on student's conceptualisation in the studio learning (Adi, Khaidzir and Said, 2015, Adi, Said and Khaidzir, 2014).

Thus, it showed there is a gap in the existing literature of architectural knowledge of design processes as perceived by students in the studio learning, particularly in Malaysia. Although there are growing interest among the scholars globally studied about the design process, however, there are still little research to be found that explores on how the students perceived and conceptualised design while undertake design process in the studio learning environment. Therefore, a study on the conceptualisation of architectural design process among the students is necessary, as it promotes a new trend of research on architectural education in Malaysia.

Table 1.4: Theoretical gap on the architecture studies

Discipline 1: Environmental behaviour		
<i>Authors</i>	<i>Concern of research</i>	<i>Parameter measured</i>
Examples includes: Tazilan et al. (2006), Said et al. (2005), Sid (2007), Sahimi (2012), Yatiman et al. (2013)	Evaluation on the environmental issue and design that impacted to the community	<ul style="list-style-type: none"> • Toilet design • Garden and landscape design • Hospital design • School and classroom environment • Homeschool journey and rural environment • Urban neighborhood
Discipline 2: Learning and instruction		
<i>Authors</i>	<i>Concern of research</i>	<i>Parameter measured</i>
Examples includes: Graham (2003), Bailey (2005), Darus et al. (2007), Abdullah et al., (2011), Utaberta and Hassanpour (2012), Oh et al. (2012), Utaberta et al. (2011), Demirkan & Demirbas (2008; 2010), Osman et al. (2009), Hushin & Rahim (2010), Ayob et al. (2011)	Evaluating studio critique assessment, curriculum design and learning outcomes in architectural design. It focus on the range of students' generic skills and performancess	<ul style="list-style-type: none"> • Types and effect of studio evaluation system on students • Learning styles and preferences • F.Y.E perceptions • Sustainable curriculum • Leadership
Examples includes: Sachs (1999), Harris (2004; 2004), Tucker & Reynolds (2006), Baqutayan and Mai (2011), Surat et al. (2011), Rao & Arbi (2012)	Focus on effective teaching and learning approaches for both student-lecturer interaction	<ul style="list-style-type: none"> • Pedagogical approach • Threats and dilemma • Teaching-research links • Teaching methods • Project-based learning • Types of knowledge
Discipline 3: Design cognition		
<i>Authors</i>	<i>Concern of research</i>	<i>Parameter measured</i>
Examples includes: Schon (1983), Cross (1990), Roozenburg and Cross (1990), Oxman (1999), Dorst (2004), Uluoglu (2000), Ho (2001), Lawson (1994;1997), Khaidzir (2007), Emir and Duzgun (2008), Khaidzir and Lawson (2012)	Conceptual thinking, reflection and knowledge structures of the previous design segments and activities	<ul style="list-style-type: none"> • Reflective learning • Design memories and situations • Interactive learning • Cognitive approach • Design memories and situations • Personal attributes and creativity
Examples includes: Goldschmidt (1991), Goel (1995), Casakin and Goldschmidt (1991; 2001; 2003), Casakin (2004; 2007)	Variation of types of sketches, idea development, approaches and strategies in reasoning design problems, and generation of cognitive processes and actions among users	<ul style="list-style-type: none"> • Types of sketches and motives • Imagery, analogies and metaphors • Types of cognitive processes

1.4 Research Aim

The aim of this study is to identify how the students conceptualise design ideas in the design process of studio learning environment, specifically in the third year architecture design studio in the Faculty of Built Environment, Universiti Teknologi Malaysia, Johor Bahru.

1.5 Research Objectives

To achieve the research aim, the following objectives were formulated:

- i. to explore conceptualisation of design ideas by architecture students in design studio;
- ii. to identify the different conceptualisation approaches by the students;
- iii. to categorise the concept sketches produced by the students in the study.

1.6 Research Questions

From the literature, it is assumed that ideas are always explicated in vague and half-formed (Fish and Scrivener, 1990). It is thought that while reasoning, students linked their previous experiences of site and precedents to recognise and criticise the current design problems and situations (Gero, 1999). This mean that the students is trying to recall and recognise of their previous design segments that provide linkages to the related design problems (Oxman, 1999). Therefore, it is assumed that active engagements of students in design such as revisiting, repeating and sketching design may significantly influence the students' reflection in action. It is also anticipated that students' engagements with the learning environment may also be influenced by the factors of self-actualisation and creativity.

As the study aimed on how the students conceptualise design ideas in the design process, there involves three steps that included an exploration of the perceptual aspects of the students' pertaining design ideas. Firstly, exploring student's perceptions is vital to understand of how the students perceived the design ideas. Secondly, understanding of the design stages and activities occurred in the studio learning guide towards the differences of student's sketches in the design process. Thirdly, identifying the factors is crucial in order to understand what assist the students in tackling the design process. From these three stages, the study discusses why are there differences of design activities, sketches or actions undertook by the students in the design process of studio learning environment.

Table 1.5 illustrates the framework of the research questions with regard to the aim, assumptions, and objectives of the study. There are three research questions that seek to explore: (i) how the students identify and generate design ideas, (ii) what are the differences in student's sketches, activities and actions, and (iii) the properties of design that influence the student's design process in the studio learning environment.

Table 1.5: The framework of research questions to aim and objectives

AIM: To identify how the students conceptualised design ideas in the design process of studio learning environment.		
Key research question	Research Question	Research Objective
What is the appropriate framework that describe the conceptualisation process among the architectural students?	RQ1: How the students conceptualised design in the studio?	1. To explore conceptualisation of design ideas by architecture students in the design studio
	RQ2: What are the differences in student's sketches in the design process? Why?	2. To identify the different conceptualisation approaches by the students
	RQ3: What are the properties of design that influence the student's design process?	3. To categorise the concept sketches produced by the students in the study

1.7 Scope and Variables of the Study

The study is based on experiential learning research which investigates student's reflection in action. The scope of study explores the perpetual student's responses of design process in term of identifying problem and conceptualising design ideas of their design task. The student's responses in identifying those problem and design ideas are extracted from their sketches. The data rely on the iteration of students' actions in revisiting, repeating and sketching their design ideas. The iteration in design process of studio learning environment involved a cyclic process of prototyping, testing, analysing, and refining a product or process (Buckingham et al., 1997). As much, the design process starts with defining problem as a crucial point to emerge design, whereas iteration aids the students by incrementally refining design based on evaluation of forms and functions.

In the perspective of studio learning environment in Universiti Teknologi Malaysia, design process involves seven stages: (1) problem identification, (2) information gathering, (3) concept generation, (4) concept resolution, (5) design solution, (6) schematic design, and (7) detail design (Khaidzir, 2014). This study focuses on how the students identify the design problem and at the same time conceptualised and evolved their design ideas to solve the design task. Therefore, in order to understand the student's conceptualisation, exploring the design activities perceived in the student's sketches is crucial. Therefore, the design activities is the dependent variable for the study. As much, the students' sketches produced in the design process is a longitudinal context that explains the relationship within the context based on what the students has perceived, understood and rationalised. Thus, the students' reflections is the independent variable that expected to shape the student's conceptualisation in the design process. Figure 1.3 illustrates the relationship between the dependent and independent variables for the study.

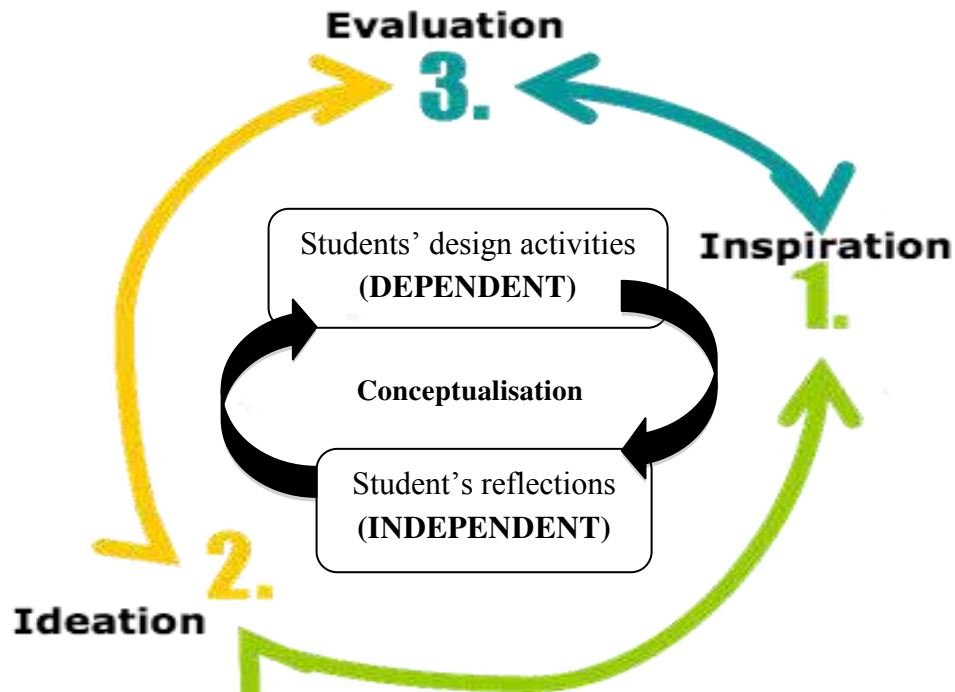


Figure 1.3: Dependent and independent variables of students' design process in the conceptualisation study

The study targeted on a group of third year architecture students in the Faculty of Built Environment, Universiti Teknologi Malaysia. The study was conducted in semester 1, session 2014/2015 of course subject SBEA 3158, which represented the architecture design studio as the context of the study. The selection of the students is based on purposive sampling. This is discussed in detail in Chapter 4 of Research Methodology. It is beyond the scope of this study to examine the student's behavioural responses in the design process due to different gender, ethnic, cultural styles, and student's learning styles. This is because ones skill are blended of multiple talents or intelligence regardless of their gender, ethnic or cultural background (Gardner, 2008; Smith, 2008; Armstrong, 2010). However, the student's rational and logical basis are consistently resulted from their self-actualisation of the phenomenon, event or problem.

1.8 Significance of Study

Significant of the study are respond to follow;

- i. The study adds to the body of knowledge that sketches and iteration play an important role in student's conceptualisation in the design process to represent the architectural learning, which has not been tested before in the local context;
- ii. A framework of analysis which emphasises the importance of design activities in the design process, representing factors and elements of design of which the students need to be engaged in order to formulate design learning. The formulation of the framework is based on student's perceptual responses and their sketches to the actualisation of design knowledge.

1.9 Outline of Research Methodology

The study explores the properties and attributes that influence student's conceptualisation of architectural design process in the studio learning environment. The design process occurs in the studio learning involves iterative, therefore, the methodology employed a content analysis and qualitative study in order to understand of how the students perceived their design sketches, activities and reflections. The study also employed a correlation design in a case study research to establish relationships between the student's sketches and approaches. The study utilises of case studies from 6 students from the third year architecture design studio as its main respondents. Comparing the design sketches and works from these 6 students allow further understanding of the students' conceptualisation in identifying design problem and design ideas in the studio learning environment.

To achieve the aim and objectives of the study, the study was conducted in six operational stages.

- i. literature review of architecture design studies relating to the role of sketches, iteration, design stages and processes, cognitive processes and activities to further understand and construct research gap;
- ii. synthesis of theoretical backgrounds that constructed from the theory of reflective learning by Schon and episodic memory by Lawson;
- iii. synthesis of architecture programme and curriculum system in Malaysia as well as in Universiti Teknologi Malaysia;
- iv. data collection and methodology on six third year architecture students;
- v. triangulation and documentation of findings
- vi. conclusion of the study which focuses on summarisation of findings, contribution, and suggestions for the future study

1.9.1 Stage 1: Literature Review of Architecture Studies

The literature review stage provided an understanding on the role of sketching and iteration in the architecture design process. It also illustrates the characteristics and differences between the designers and students in perceiving their design tasks. The literatures also gives an insight into the disciplines that involved in research concerning the architectural design process of: environmental studies, pedagogy of learning, and design cognition. It is inferred that the first and second disciplines of environmental studies and pedagogy of design learning have been widely discussed in the local context. However, aspects in the third discipline of design cognition that focusing on the architecture reasoning, creative thoughts, and explicit design processes especially among the students are rare to be found, particularly in Malaysia context. Besides, the statistical inferences also indicate that a growing number of architecture students and institutions are increasing in both of public and private institutions in Malaysia. Therefore, it showed an urgency to conduct the study in order to understand what the students think, draw and perceived,

as well as to assist the students and benefits the educators on an ideal design process of studio learning environment.

1.9.2 Stage 2: Synthesis of Theoretical Backgrounds

Two theoretical backgrounds make up the conceptualisation study of design process: Schon's reflective learning and Lawson's episodic memory. The theories highlight on the interaction between reflective action and the constructive memory of students that aids them in conceptualised their design problem. Through the iteration process, the students criticised, refined, repeated and reflected of their conceptual ideas by actively recall and recognise of the design ideas. Therefore, it is assumed that conceptualisation is constructed as based on reflection in action whereas its interact with the aspect of iterative, reflective, self-actualisation and creativity.

1.9.3 Stage 3: Synthesis of Architecture Programme in Malaysia and UTM

The next stage focuses on the understanding of the architecture education in Malaysia as well as the architecture programme offered in Universiti Teknologi Malaysia (UTM). The chapter discusses about the background of the respondents, the enrolment procedures and the nature of architecture curriculum system in Malaysia, as well as the architecture programme offered in Universiti Teknologi Malaysia.

1.9.4 Stage 4: Data Collection and Methodology

The study employed case studies on six (n=6) third year architecture students in Universiti Teknologi Malaysia, Johor Bahru. The selection of students was based on the purposive sampling technique. Data elicited using two methods: (1) observations on student's sketches from the initial design stage to the final stage and (2) description on student's interviews and studio reflections. The data were analysed using a content analysis of segmentation and coding that based on categorisation of raw data of the student's sketches. The flow of data collection, the stages and the outputs are illustrates in Figure 1.4. Detail discussion of the methods and procedures are discussed in Chapter 4 of Research Methodology.

1.9.5 Stage 5: Triangulation of Data Analysis

Data were analysed using content data analysis. Data of the students' sketches, their reflections and interviews, as well as in-depth observations on their pins-up presentation boards were inferred to answer the research objectives and questions. The students' conceptualisation and design activities were then analysed and inferred through categorisation of themes, synthesis, and correlation analysis between the elements of design as perceived by the six students.

1.9.6 Stage 6: Conclusion of the Study

The final stage emphasises the conclusion of the study. In this stage, it summarises the findings of the study, discusses on the model of student's conceptualisation in the architecture design studio, as well as contribution and suggestions for the future study.

1.10 Outline of Thesis Content

Chapter 1 introduces the problems and background of the conceptualisation study in the design process of architecture studio learning environment. The design studio as a learning environment for architecture students seems to be characterised through sketching activities and a dynamic iteration process. In order for the students to learn to design, they have to actively engage with all these design processes to activate their architectural thinking and creative thought, which thinking and doing operations are deemed to be equally valuable and crucial in the design process.

Chapter 2 provides theoretical backgrounds and literature reviews that relates to the study of student's conceptualisation. Two theoretical backgrounds has make up the conceptualisation study: (1) Reflective Learning Theory and (2) Episodic Memory Theory, where it indicates that the nature of the studio learning environment fits with students' thinking and reasoning. The chapter outlines the role of analytical thinking and creative thoughts as well as sketches and iteration in aiding the students' design process in the studio learning environment.

Chapter 3 contextually reviews the state of architecture education in Malaysia. This chapter introduces the function of the Board of Architects Malaysia (LAM) and the Malaysian Institute of Architects (PAM) in educating and accrediting the architectural programmes in Malaysia. It also outlines the framework and channels of student's enrolment into the architecture programmes and institutions in Malaysia. In addition, the chapter also brief about the background and the existing architecture programmes offered in Universiti Teknologi Malaysia.

Chapter 4 outlines the strategies of inquiring data and methods of data analysis. The chapter also describes the study employed a case study approach with a combined strategies that fits to the nature of data and focus of the study. Thus, data obtained through observations of students' sketches, studio reflections, pin-up reviews and boards presentation, and students' interviews. Lastly, the chapter describes about the data analysis of a content analysis.

Chapter 5 presents the results and discussions of the findings. The discussions are focused on the student's design activities observed in the design process, the differences on number of student's sketches, as well as perceived elements of design that influenced the student's design process in the studio.

Chapter 6 concludes the thesis with a discussion of an overall findings including the theoretical, methodologies and design implications for the body of knowledge. It also concludes the key factor that affect the student's conceptualisation, the model of the student's conceptualisation that occurred in the design process of studio learning, as well as contributions of the study and suggestions for future study.

An overall outline of the research methodology and thesis content for the study is illustrated in Figure 1.4.

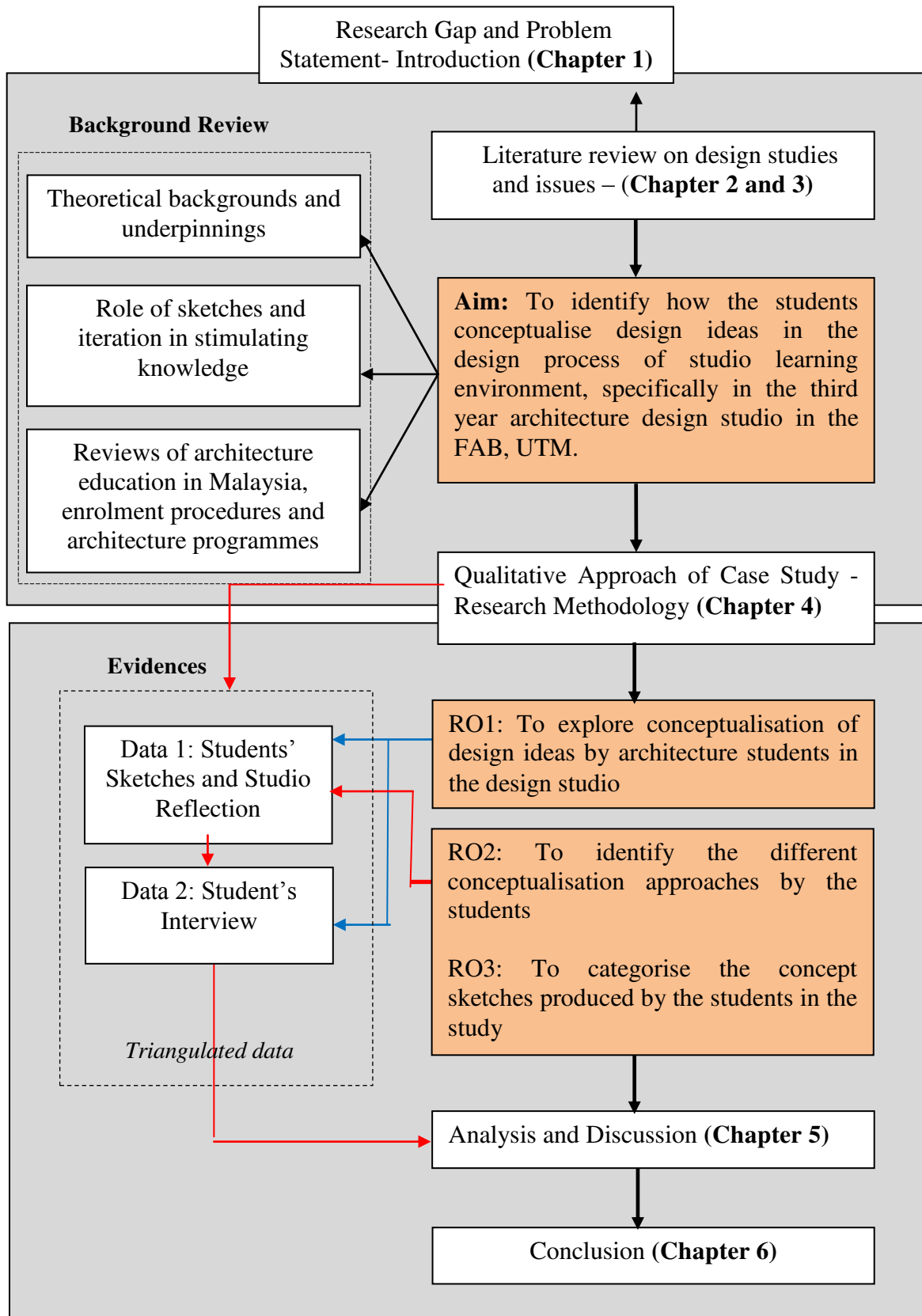


Figure 1.4: Thesis objectives and structure

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