ARCHITECTURE DESIGN STUDIO PEDAGOGY FOR TRANSLATING ENVIRONMENTAL SUSTAINABLE ELEMENTS

BASHIR FAIZAH MOHAMMED

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Universiti Teknologi Malaysia

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To my beloved parents (Mohammad Bashir Abubakar & Amina Muhammad Bashir), my beloved Husband, (Dodo Yakubu Aminu) and my children (Al-Amin Yakubu Aminu and Aminah Nur-Huda Yakubu Aminu)

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ABSTRACT

Sustainable design helps reduce negative impacts on the environment and improve building performance. The architectural educators strive to impart the sustainable requisite to students. Based on the literature review and the results of an exploratory study conducted, it is evident that the pedagogy employed by Universiti Teknologi Malaysia (UTM) architectural educators follows reflective-in-action and Kolb's theory. However, the environmental sustainable design elements are not reflected in most architectural design studio curriculum. In fact, only a few courses have elements of environmental sustainable design embedded in them. This research aims to determine the manner in which architectural educators in UTM translate environmental sustainable design elements to students. A mixed method was employed in this study: observation on the second year environmental design studio was done for four (4) months (n=7); a questionnaire was distributed to all architectural students (n=150), and interviews of educators (n=17) involved in work-base studios in the department of Architecture were conducted. The data from the observation was analyzed with categorical data analysis with a percent agreement set at 70% inter-coder reliability coefficient. The questionnaire was analyzed using SPSS version 20, with a one way ANOVA set at $p<0.05$ significance level to obtain results for inferences, while the interviews were analyzed by content analysis. Results on the analysis show that the architectural educators imparted aspect of environmental sustainable design elements directly to the students through various pedagogies, and the students used those environmental sustainable design elements in their design studio work. The results also reveal that the architectural curriculum is a hidden curriculum which embeds sustainable design elements; however, understanding of building ecosystem and ability to design sustainable buildings are not enforced on the students across all the design studios. It is only mandatory in the second semester of the second year studio since the theme is on the environmental paradigm. This implies that in order to empower students with the ability to design environmental sustainable buildings, more sustainable core subjects could be included in the studio curriculum. Findings could be employed by architectural educators and policy makers as a guide for future curriculum upgrading and development.

ABSTRAK

Rekabentuk lestari membantu mengurangkan kesan negatif ke atas alam sekitar disamping meningkatkan prestasi bangunan. Para pendidik senibina berusaha untuk menerapkan keperluan ilmu berunsurkan reka bentuk lestari kepada pelajar. Berdasarkan kajian literatur dan hasil dari kajian eksplorasi menunjukkan bahawa pedagogi yang digunakan oleh pendidik kursus senibina Universiti Teknologi Malaysia (UTM) adalah mengikut teori pembelajaran reflektif dan Teori Kolb. Walau bagaimanapun, elemen reka bentuk lestari alam sekitar tidak dinyatakan dalam kurikulum. Malah, hanya beberapa kursus yang mengandungi elemen reka bentuk lestari alam sekitar. Kajian ini bertujuan untuk menentukan bagaimana pendidik kursus senibina di UTM menterjemahkan unsur reka bentuk alam sekitar yang mampan kepada pelajar. Kaedah gabungan digunakan dalam kajian ini iaitu dalam bentuk pemerhatian pada studio Tahun 2 reka bentuk alam sekitar selama empat (4) bulan (n = 7); satu soal selidik telah diedarkan kepada semua pelajar seni bina (n = 150) dan wawancara dengan pendidik (n = 17) yang terlibat dalam kumpulan berasaskan kerja studio di Jabatan Seni Bina telah dijalankan. Data dari pemerhatian dianalisis dengan analisis data kategori dengan persetujuan peratusan yang ditetapkan 70% pekali kebolehpercayaan antara kod. Soal selidik dianalisis dengan menggunakan SPSS versi 20 serta ANOVA yang ditetapkan pada $p < 0.05$, iaitu tahap penting untuk memperoleh keputusan untuk kesimpulan, manakala wawancara dianalisis dengan analisis kandungan. Dapatan analisis menunjukkan bahawa para pendidik senibina menyampaikan aspek elemen reka bentuk lestari alam sekitar secara langsung kepada pelajar melalui pelbagai pedagogi, dan para pelajar menggunakan elemen reka bentuk alam sekitar lestari dalam reka bentuk studio mereka. Dapatan ini juga menunjukkan bahawa kurikulum senibina adalah kurikulum tersembunyi yang memaktubkan elemen reka bentuk yang lestari. Walau bagaimanapun pemahaman tentang pembinaan ekosistem dan keupayaan untuk merekabentuk bangunan lestari tidak dikuatkuasakan oleh para pelajar di semua studio reka bentuk. Ia hanya mandatori kepada studio tahun dua, semester dua sahaja yang bertemakan paradigma alam sekitar. Ini menunjukkan bahawa untuk memperkasakan pelajar dengan keupayaan merekabentuk bangunan lestari alam sekitar, lebih banyak mata pelajaran teras yang berasaskan kelestarian boleh disertakan dalam kurikulum studio. Dapatan ini boleh digunakan oleh pendidik kursus senibina dan penggubal dasar kurikulum sebagai panduan untuk peningkatan dan pembangunan kurikulum senibina pada masa depan.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter introduces the study by explaining the background of the study. Stating the problem statement, the aim and objective of the study, the research questions, the scope and limitation of study likewise the research gap. It also briefly explain the theoretical framework which consist of Kolb's theory and Brundtland sustainability theory. The research design was also explained in the chapter, as well as the significance of the study and the overall thesis organization.

1.2 Background of the Study

Agenda 21 (UNCED, 1992) encourage all countries to make sustainable elements as a national priority, with widening the scope of sustainability to all sectors of the community and specifying objectives in each sector. In the construction industry, in the field of architecture, the Hannover principle which was formulated by McDonough and Braungart (1992) is a set of statements about the design of building with thinking about environmental impact, the impact on sustainable growth and the entire effect to the community. In addition, Mazria (2006) has taken an initiative called the Imperative 2010 and Architecture 2030. Imperative 2010 is a plea for architectural schools in the United States as well as architectural schools around the world to include the environmental elements and sustainable elements in the syllabus of architecture course (Malsiah, 2011).

Educators in architecture program have unlimited charge in assimilating sustainability into the existing curriculum. Designers and architects have a lot to do in preventing destructive environmental penalties by adopting sustainable design practices since expert practices and performance are mainly embedded in education and the principles studied (Gurel, 2010). Likewise, the government of Malaysia has taken positive majors of partaking governmental policies on sustainable development in resolving the energy problem ever since in the Seventh Malaysia plan in 1996. The government of Malaysia targets that, by 2020 Malaysia should be fully developed country and their priority is on environmental sustainability, thus demanding Malaysia to make sure that the valued natural resources are not wasted (Rao and Arbi, 2005). National Green Technology Policy launched in 2009, aims 4 sectors that are energy, water, buildings, transportation as well as waste management. This policy outlines the following for the building sector: "Adopting green technology, management, building preservation and distortion of buildings". The statement above must be observed by architects and architectural education in Malaysia. Architecture field needs to act practically in recognizing the objective to attain this National Green Technology Policy (Malsiah, 2011). In integrating and impacting sustainability to students, architectural educators must use appropriate pedagogy.

Educational systems make every effort for students to perform at very high levels irrespective of the procedure used to regulate student performance. Quality teaching is known as the most important element in student learning. Hence, having environmental sustainable design add to improved teaching makes a strong argument to uphold and even increase its role in educational systems (Laurie *et al*., 2016).

1.3 Problem Statement

Three elements are used to propagate sustainable issue; awareness, technology and policies. Like wise environmental sustainable requirements are being transformed in many Architectural school across the globe. Architectural education has been slow for years to react to a novel set of requirements, having a tendency to

accept the general opinion that the environmental aspects of buildings were for the engineering profession (Altomonte, 2012). Is just of recent times that the insight of environmental design and energy efficiency has moved from specialist technical concern to a more related position on the schedule of architectural education (Altomonte, 2009). Though, while this is considerable, this change of insight has not yet been steadily coordinated with a pedagogy that is completely inserting sustainable environmental design elements at the core of the architectural curriculum. Students should also be encouraged to put emphasise on consideration and critical self-evaluation so as to be able to face the challenges involved in harmonizing design integrity with environmental concern.

Conversely, in the existing pedagogies, environmental design is not normally regarded as a basic, important and integrated requirement (and valuable input) of the design project itself, but as an ordinary positive addition to a successful scheme, (Altomonte, 2009). Brian Edwards (2003), outlined the sustainability and architectural education in the United Kingdom, stating that out of 36 schools 22 architecture schools have courses with details on sustainability. It summaries that sustainable design is deliverd through lectures and studio but hardly are they combined. The social and economic sustainability gained little attention and energy efficiency in buildings has the major emphasis.

Environmental sustainable design should be taken as the main concern in the education of building practitioners from the commencement of the studies and through out the professional process. Pedagogical methods have to stay away from transmissive educational models, to foster critical and holistic thinking and building systematic relations concerning different cognitive domains. (Altomonte, 2012). Environmental sustainable design is not only exclusively about energy efficiency and carbon emissions reduction, but it is primarily a transdiciplinary domain as well as a good responsibility and an opportunity for motivated architecture (Altomonte, 2012). The idea of sustainability has risen in reaction to numerous environmentally friendly problems during the last two decades. Environmental awareness was higher as a response to the general irresistible universal environmental ruin. Duggan and Mitchell (1997); Lenard (2003); Hauck *et al*. (2013) and Knights *et al*. (2014) found

out that matters on policy, law, policy-making, and decision makers have put out rules and procedures in solving this environmental issue with educational curriculum as a bedrock to part of the solution.

All schools of architecture in Malaysia has advanced without any critical investigation done on the pedagogy of teaching of the most important subject which is the Design Studio (Surat *et al.*, 2011). Previous studies have shown that sustainable development poses a challenge for pedagogy in all fields. Khalid (2012) findings show the unbalanced importance given to different sustainability dimensions, while, Moalosi, Rapitsenyane and M'Rithaa, (2010), ascertain that few schools include sustainability issue in their curriculum. Abdul Rahman, Abdul Samad and Wan Harun, (2012), infer that there is a need for revamping the Malaysian architectural curriculum to take in sustainability as the main learning outcome. In another study by Malsiah (2011) finding was on identifying the environmental elements used in designed studio in the sustainability context. Olotuah, Taiwo and Ijatuyi, (2016), shows the strength of effective pedagogies in architectural education as the design studio is central to architectural program and the practice of architecture.

The research proposed a framework for empowering the students with the ability to designed environmental sustainable buildings. More sustainable subjects proposed to be included in the curriculum and probably be employed by architectural educators and policies makers as a guide for future curriculum upgrading and development.

1.3.1 Discussion

Sustainable development should not be treated monolithically but should be addressed holistically (Olufunto and Olatunde, 2013; Nikezić and Marković, 2015). Discussions on how sustainable built environment can be effectively delivered to learners are still gaining momentum (Nikezić and Marković, 2015). One of the ability to implement this lies in the future generation in which architectural students

are part of, who designed the future environment lies in their palm. The educators have the responsibility of making the students understand the issues from basics.

However, it shows that over the last two decade the elements of environmental sustainable design has been in the process (Yilmaz, 2006), in which architects and engineers have established methods to building design that significantly reduce the effect of buildings on the natural environment and their human occupants (Nute, 2017). Therefore this study investigate the pedagogy that architectural educators use in translating elements of environmental sustainable design to the students, in order to determine the way forward in achieving a sustainable world through the impact on the students' ability to design and achieve a greener earth.

1.4 Research Gap

There are researches in design course content, particularly on elements of the environmental and design content as well as elements of sustainable design (Malsiah, 2011 and Abdul Rahman & Abdul Samad, 2009). Research conducted on the content of the studio program (Maturana, 2009), argues that architects' contribution to crucial issues, such as climate change will remain ineffective without meaningful engagement with society. There is a need for incorporating tools of measuring sustainability in the studio. In another studies (Maturana, 2010; Maturana, 2014) emphasize that practice is synonymous with university education in architecture design studio. In essence, there is a need to introduce environmental sustainable elements in the studio program as it connects the architectural students and the outside world. But the emphasis in the study by Malsiah (2011) is on the content of design course; in the context of its relations with environmental elements in the design studio. Therefore, this study is on architectural design studio pedagogy for translating environmental sustainable elements.

Environmental design teaching in the School of Architecture University of Santiago 2003 emphasised on the notion of learning by doing. Some studios are

involved in new pedagogical practices in relation to environmental design from an experiential point of view, in recent, the school implemented a factory/laboratory for the students that focused on real building (Martinez, 2011). In University of Nottingham 1st year curriculum introduces students to the environmental agenda. The module inspires considering environmental issues from the beginning of a project and discovers the important bioclimatic strategies to improve the comfort condition of the occupants. It also presents simple systematic tools and procedures to discover and comprehend environmental strategies within design projects. It was initiated based on learning by doing techniques, concepts and principles all together with their application in real-world projects. The lectures carried out during the first semester focused on the sustainability agenda in architectural design perspective, present topics on environmental psychology issues, thermal, visual comfort and acoustic were introduced. In the second semester, the study of daylighting in buildings was dedicated. The transfer of knowledge was reinforced by a sequence of group projects and a final individual assignment (Altomonte, 2012).

The quest for a department of Architecture that would have the issue of sustainability and resilience in the built environment saw the University of Strathclyde Glasgow establishing built environment education and architectural pedagogy in 2014. Its aim is to bring together past, present, and future efforts undertaken by architecture staff into today's rapidly changing academic world. The pioneering Architecture educators in this aspect includes professor Ashraf M. Salama, professor Gordon Murray and Mr. Michael Angus. All of the educators have a long and well-established tradition of exploring learning practices in architecture, building construction, and urban design. The core value was build around integral to contemporary design pedagogy: critical thinking and inquiry, creativity and innovation, research and investigation. This was guided by the ideals and beliefs of 'the place of useful learning,' (University of Strathclyde Glasgow, 2014).

In Universiti Sains Malaysia (USM), the sustainable design elements were introduced since 2004, it started by awareness in the first 1st year studio. Testing of the understanding and comprehension of all the theories and studio work from 2nd to 5th year the final year theses are assesed partly in the implementation of the issues.

Also the 5th year offers building technology that expose them to field trip and case study of completed buildings in the country (Abdul Rahman & Abdul Samad, 2009). There is no study carried out yet on the pedagogy of design studio in relation to environmental sustainable elements in Universiti Teknologi Malaysia (UTM). Therefore this study focus on the pedagogy of elements of environmental sustainable design in the architecture design studio. This redearch is an extension of Malsiah (2011) thesis on elements of environmental design in Malaysian Universities, however, this study tends to look into the pedagogy used to teach these elements in UTM.

The study focused only on UTM because it uses most of qualitative method. In qualitative method, considerable amount of time is required to be spent with the participants as highlighted by Miles and Huberman, (1994); Punch (2005); Punch (2009); Langseth (2009); Richards and Munsters (2010). It need the reflections of everyday life of individual, groups, society or organization (Capuzzi and Gross, (2013), thus it gives a detail process of how individual come up with their design process. Similar studies did used one institution as similar cases used by Gurel (2010) and Mokhtar (2011).

1.5 Aim

To investigate the pedagogy at which architectural educators translate elements of environmental sustainable design to students in Universiti Teknologi Malaysia.

1.6 Research Objectives

1. To evaluate the pedagogy used by Architectural educators in an environmental design studio at the department of Architecture, FAB, UTM.

2. To synthesize the process of teaching and learning of elements of environmental sustainable design.
3. To analyze the perceptions of Architectural students on the pedagogy of environmental sustainable design elements in relation to cognitive domain of Bloom's taxonomy.
4. To propose a framework for pedagogy of environmental sustainable design elements.

1.7 Research Questions

1. Do architectural educators follow any pedagogical pattern in translating environmental sustainable design elements in Universiti Teknologi Malaysia?
2. Do the various pedagogy used by architectural educators in UTM have an impact on how students translate the environmental sustainable elements they learned?
3. What is the perception of the Universiti Teknologi Malaysia Architecture students' on environmental sustainable elements?

1.8 Scope and Limitation of Study

This study is related to sustainability, emphasis was placed only on environmental sustainability. Based on the passive and active elements of sustainable design, which focused on the pedagogy of environmental sustainable design as shown in Figure 1.1. How the architectural educators teach their students in relation to the elements of environmental sustainable design in the department of Architecture, FAB, Universiti Teknologi Malaysia. It considered seventeen (17) educators that are work base masters in design studio with some of them specialized on environmental sustainable design and expert in architectural pedagogy. The pedagogical study was tested on architectural students undergraduate year 1 to year 3 students and postgraduate masters students year 1 and year 2 using questionnare. The

questionnaire checked on how the new curriculum has embedded environmental sustainable design into the system. The transition between the UTM old curriculum (5year straight) and the new curriculum (3years + 2years) during the cause of the study could have had effects on the result, as the result is an outcome of the transition. The study carried out was based on three (3) components of pedagogical analysis (Teaching objectives, subject content, learning materials and methods) as described by Bhowmik *et al*. (2013) in Figure 2.1. Although, assessment (evaluation devices) which is the fourth component was not included.

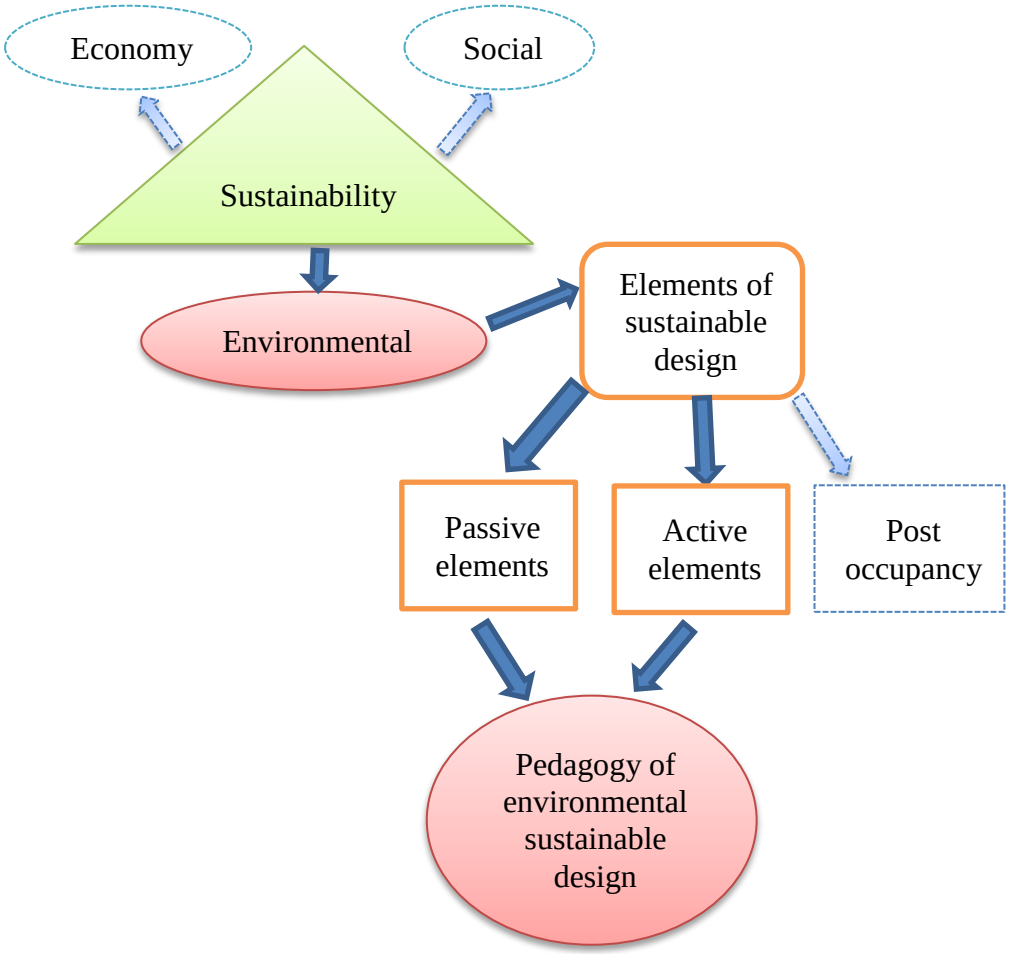

Figure 1.1 Scope of the Study

1.9 Theoretical Framework

In this research more of the qualitative method was used, while quantitative method was used less to triangulate the result as done by Faruk *et al*., (2010). In

addition, for the purpose of this study, two theories were adopted: Kolb (1984) theory of teaching and learning as well as WCED (1987) Brundtland report on sustainability theory. Also, the in-dependable variable (IV) and the dependable variables (DV) are included in the theoretical framework as shown in Figure 1.2. The Six (6) elements were chosen only in the scope of this research which are the sustainable site, energy efficiency, daylighting, rain water harvest, materials and resources and innovation.

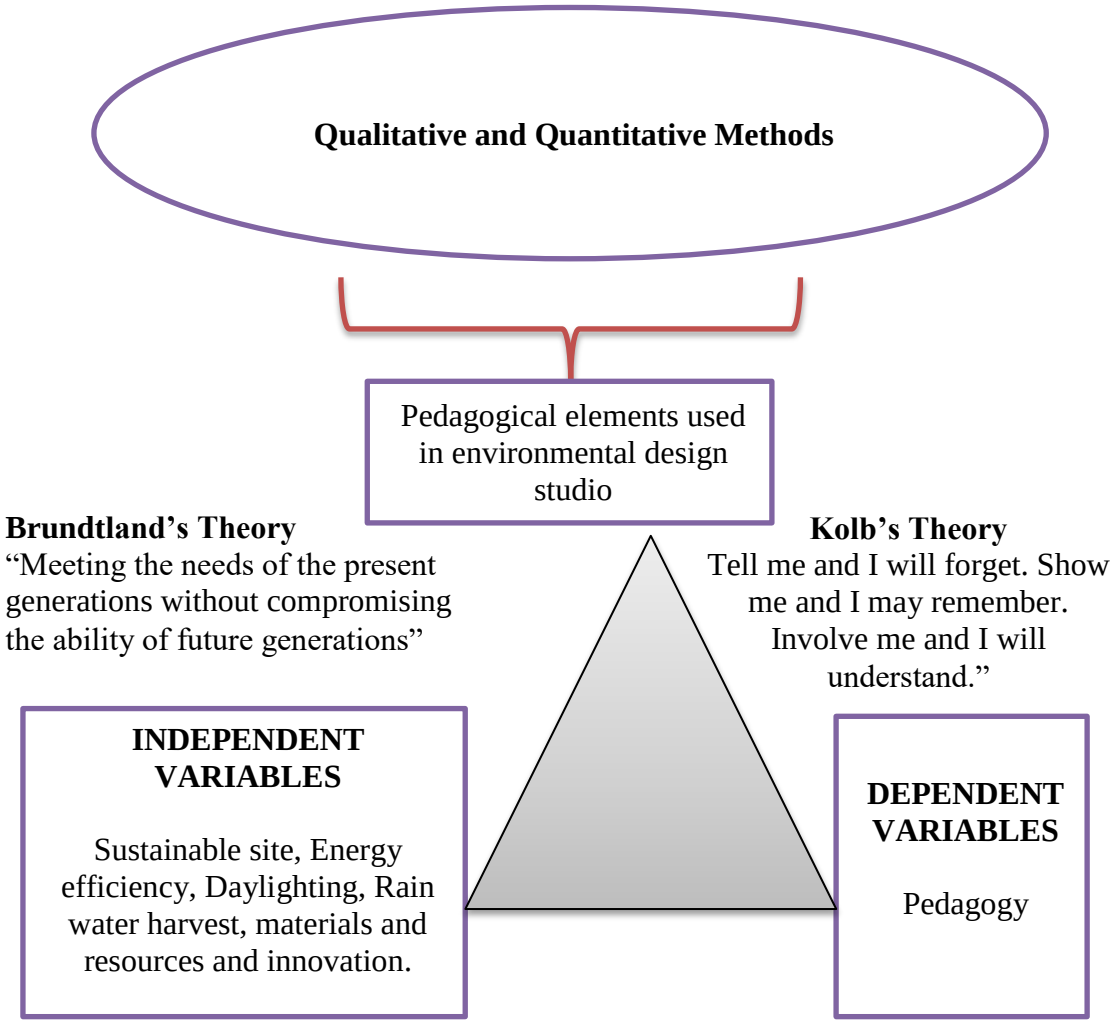

Figure 1.2 Theoretical Framework of the Study

1.9.1 Kolb's Theory

Kolb (1984) expressed the view that experience has to be an essential element of any teaching and learning process. It is clear by the renowned saying of Confucius about 450 BC "Tell me and I will forget. Show me and I may remember. Involve me and I will understand." Experiential learning is the learning that the reality studied is been in contact directly by the learner (Keeton and Tate, 1978). It is compared with the learning that allows the learner to only hear, talk, read and write about the realities studied, but certainly not interacted with throughout the process of learning. Though, there are educators that wrongly connect experiential learning with only "off-campus" or "non-classroom" learning (Salama, 2010a).

Pedagogy centered on learning by doing, by means of investigative "hands-on" project given during the transfer of knowledge, can involve students in learning, initiate desire and interest for sustainability, and inspire the students towards the development of architecture through environmentally sustainable design (Altomonte, 2012). Students need direct experience to gain knowledge of ethics and practices of sustainability. The learning environment should be of collaboration and activity, promoting active relations in theory and in the design studio (Savage *et al*., 2015; Altomonte, 2012). The pedagogy can be strengthened by the use of field trips and sketch or photographs of traditional and modern case studies to visualize the concepts offered. Not only international or national schemes for sustainability will be included, but a critical understanding of historical, cultural and social backgrounds, that would help to set questions and properly infer possible responses should also be included (Gomez-Lanier, 2017; Altomonte, 2012).

Kolb's theory is used in this study because is declared as a learning theory that approves all main phases of active learning (Sharlanova, 2004 and St. Laurent, 2010). It delivers theoretical argument of learning by doing, independent learning, problem-based learning and work-based learning (Sharlanova, 2004; Holdings, 2014). The theory has an enormous collection of application, help students recognize themselves (Sharlanova, 2004; St. Laurent, 2010, Salibio, 2014) help teachers become instinctive teachers, recognize students learning styles, and develop

important teacher's skills. It also helps to improve team project work and determine how information and communication technologies can help the process of learning (Sharlanova, 2004). The advantages of Kolb's theory can be summarised in the following:

Offers ready instructions for application, gives instructions for the necessary collection of teaching methods, make available effective connection between theory and practice (St. Laurent, 2010 and Holdings, 2014). Provide a theoretical argument of approaches that many teachers use and need assistance on how to amend their practice (Sharlanova, 2004). Clearly expresses the importance of students to show the importance of getting feedback so as to motivate their learning (Sharlanova, 2004). Helps to justify the combination of learning styles to make learning more effective (Sharlanova, 2004; St. Laurent, 2010 and Holdings, 2014). It is suitable for all subject areas, an individual, groups or entire institutes can make use of it. Can be used in a specific class, session, or long course of study (Sharlanova, 2004).

1.9.2 Brundtland Sustainability Theory

Sustainable development is the development that allows the current generation to harness its resources in a way that it will have little or no effect on the uses of the next generations (WCED, 1987). This was the slogan used for the Gro Harlem Brundtland led commission report of the United Nations World Commission on Environment and Development (WCED) that is being circulated since 1987. Its main objectives were the participation of government of different countries and interrelationship of nations in the exploration of a sustainable development. Sustainable development is composed of environmental, social, and economic sustainability. One major focus by Our Common Future is that several disasters facing the planet are connecting disasters that require the active participation of all facets of the society to act on the deliverance of the problem of sustainability "the present meeting their needs by not depriving the efficiency of prospective generations to congregate their own needs." This plain definition is derived from the Brundtland Commission and has been generally recognized as a definition for

sustainability. As illustrated in Figure 1.3, the definition is centered on three connected "pillars" that, when all are encountered, form sustainability.

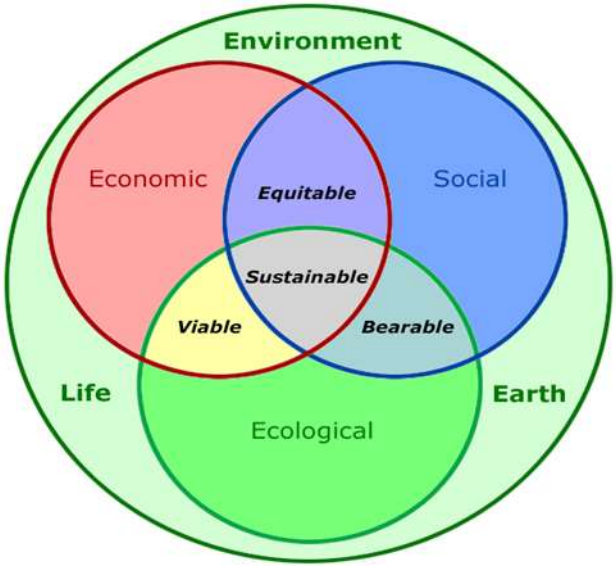

Figure 1.3 Concept of Sustainability. Source: Nektarina, (2013).

1.10 Research Design

The idea adopted in this study is shown in Figure 1.4 as the activities that happen between educators and students in the environmental design studio. The pedagogy used by the UTM architectural educators as it is designed in the old curriculum and new curriculum with a focus on environmental sustainability. A leap through the existing condition of architectural education was carried out as well as the pedagogies used from the literature.

Teaching and learning process was investigated in an environmental design studio with a focus on environmental issues only, although, the components of sustainability have three variables (Environmental, Social and Economic).

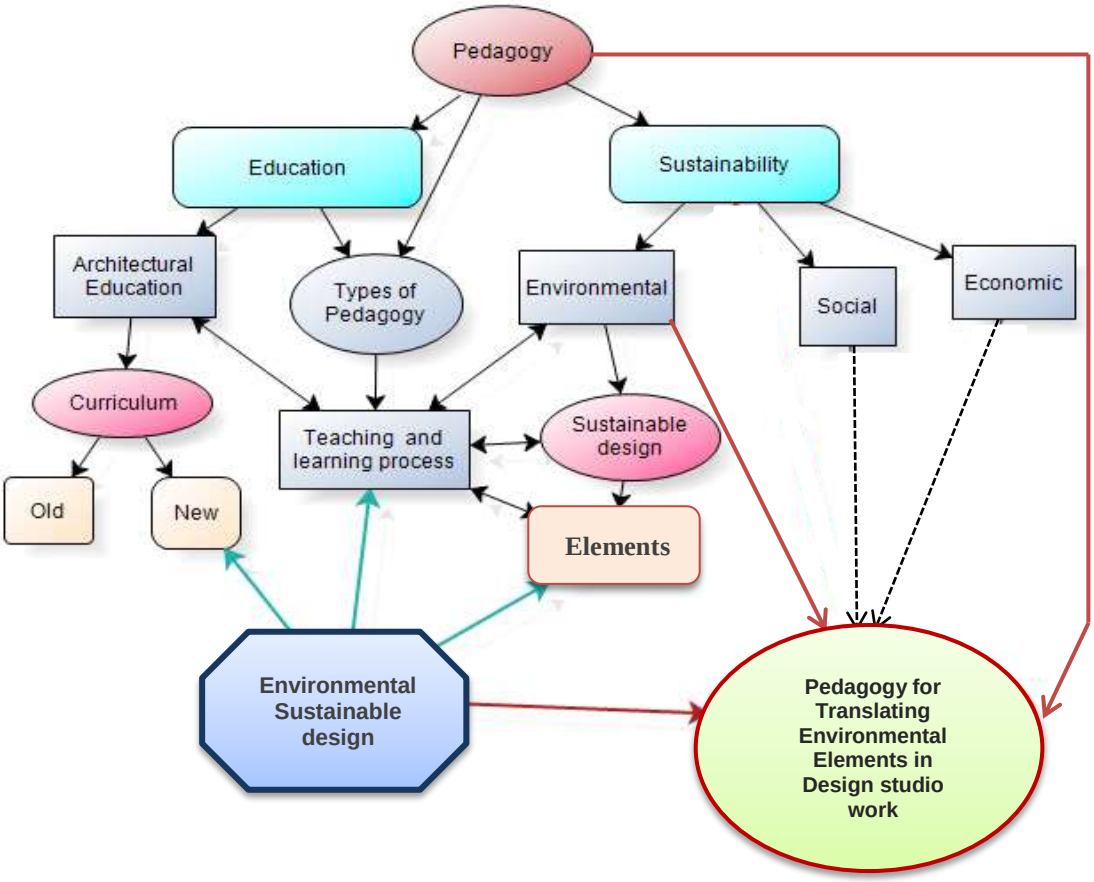

Figure 1.4 Conceptual Framework for the study

1.11 The significance of the study

1. The study highlights some elements of sustainability which is a possible solution to global warming, but it focused only on a sustainable design which is under environmental sustainability.
2. This study suggests possible improvement of environmental sustainable design pedagogy for Universiti Teknologi Malaysia by allowing the architectural educators and those in charge of the curriculum to be acquainted with the different pedagogies to use in translating elements of environmental sustainable design to the students so that they incorporate the elements in their design.
3. From the literature reviewed, new pedagogies were identified from the core values of proposed 4th Industrial Revolution (4th IR) as it relates to the sustainable development goals No 4 (quality education).

The 4th IR finds its core around 3 pedagogies (Heutagogy, Paragogy and Cybergogy) and it all tied to the industries. These pedagogies might in the future influence the curriculum and the process architecture educators would translate elements of environmental sustainable design.

4. A framework for environmental sustainable design pedagogy is proposed to serve as a guide for architectural educators in UTM and Malaysia

1.12 Report Organisation

This report consists of six (6) chapters as explained below:

Chapter One introduces the main issue and focus of this research. This chapter discusses the research questions, research gap, and research objective. Besides, the scope and the research limitations are also discussed. This chapter also enlightens the significance of the study and the overall report organization.

Chapter Two defines pedagogy, types of pedagogy, different pedagogical approaches, teaching, learning, and effective pedagogy, Bloom's taxonomy and the role of architectural educators. It went further to review design educations, pedagogy in architecture, pedagogy in environmental sustainable design studio were also discussed. Besides curriculums, curriculum in architectural education, contents in Universiti Teknologi Malaysia (UTM) old and new curriculum were also presented. The chapter discusses lastly difference and similarities between the UTM old and new curriculum, transformative pedagogy and hidden curriculum, the architectural educator, and the hidden curriculum and the method employed in the assessment of student work.

Chapter Three is literature review on sustainability, the definition of sustainable development, designs in architectural education, a design studio in architectural education, and the studio as its own world. It went further to explain

about environmental sustainable design studio, sustainable design, benefits of sustainable design, sustainable design elements, and knowledge base of the sustainable environmental design. Basic buildings design, the tree of solar strategies with passive solar considerations, passive elements in the design, active and passive solar circle were also discussed. Elements for this research, sustainable building /green buildings, assessment, assessment of sustainable buildings, assessment of design, elements used in the study and proposed framework for environmental pedagogy for design studio were all explained in this chapter.

Chapter four discussed on the research paradigm, the methods that were carried out in the research including the research flow, quantitative method, qualitative method, mixed method and the methods of reasoning used in the main research were discussed. Observation, types of observations, coding manually, inter-coder, inter-coder reliability, measuring inter-coder reliability, percent agreement, the observation protocol reliability and validity of this research were explained. Survey questionnaires, instrument validity, and reliability, internal consistency reliability, interviews, the research tools, population sampling, purposeful sampling were also discussed. Research approach and implementation of the research were discussed lastly.

Chapter five contained the results and analysis of the research which includes exploratory result based on the interview and questionnaire for 5th-year students and a synopsis of the findings from the exploratory study. There is also categorical data analysis on overt observation on 7 students in the work base that were observed. Observation result for pedagogies used by architectural educators and sustainable elements they learn from the videos documented and the synopsis of findings from the observation result for pedagogies used by architectural educators. The interview analysis was also discussed as follows interview result of 17 educators (demography), the area of specialization of interviewed educators and procedures at which architectural educators translate environmental sustainable architectural design to students (section D). Furthermore, the analysis of questionnaire distributed to students was included result from the questionnaire distributed to students, types of pedagogy used by UTM educators. In addition, pedagogy choice by UTM students

section B, a grouping of the pedagogy by all respondents (students and educators), inferential statistical analysis of various variables section C, and ANOVA result generated from the study based research objective 2 & 3, were discussed. Besides are the pedagogical frameworks, for both Bachelor of Science (B.Sc.) architecture environmental design studio and masters architecture (M. Arch) programs. Effective pedagogy for environmental design studio work framework was proposed. The validity of the framework which includes the use of; confirmatory factor analysis, construct validity, construct reliability and convergent validity was also presented. The chapter was concluded with chapter synopsis.

Chapter six summarized the research findings, which includes: the pedagogy of architectural design studio, environmental sustainable design elements, the theoretical implication of the research, practical implication and application of the research. There are also recommendations which are divided into curriculum recommendations on pedagogical approach for the environmental studio and recommendations for assessments of the environmental design studio. The chapter also discussed research limitations and the implications for further study.

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