INTEGRATING ENVIRONMENTALLY SUSTAINABLE CONSTRUCTION IN THE ARCHITECTURAL DESIGN EDUCATION AT UNIVERSITI TEKNOLOGI MARA, MALAYSIA

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by

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MENGINTEGRASIKAN PENDIDIKAN PEMBINAAN LESTARI DI DALAM STUDIO SENIBINA DI UNIVERSITI TEKNOLOGI MARA, MALAYSIA

ABSTRAK

Sejak zaman Ecole de Beaux and Bauhaus kaedah pengajajaran di studio telah diterima sebagai kaedah yang paling teras dalam kurikulum senibina dan rekabentuk. Namun keberkesanannya dalam membentuk bakal profesional bagi alam bina yang berkualiti semakin dipersoalkan. Kajian in mencadangkan suatu alat atau instrumen yang boleh digunapakai bagi menilai secara numerikal tahap integrasi pendidikan pembinaan lestari di dalam studio senibina. Satu tinjauan survei telah dijalankan menggunakan teknik pensampelan berstrata di kalangan pelajar program sarjana muda. Instrumen yang dicadangkan merupakan sebuah soalselidik yang dibangun menggunakan lima penunjuk utama pembinaan lestari. Oleh kerana integrasi sukar diukur secara langsung, penunjuk utama pembinaan lestari dikembangkan kepada tiga dimensi integrasi iaitu tahap pengetahuan yang diperolehi pelajar, penekanan yang diberikan oleh pengajar dan kebolehan pelajar untuk mempertimbangkan isu-isu pembinaan lestari dalam rekabentuk projek mereka. Nilai Alfa Cronbach melebihi 0.7 menunjukkan bahawa instrumen yang dicadangkan mempunyai tahap kebolehpercayaan yang memuaskan. Data dianalisis menggunakan kaedah ujian - t, ANOVA dan korelasi Pearson. Integrasi di Universiti Teknologi MARA didapati berada di tahap positif walaupun tidak cukup tinggi. Sekiranya tahap pengetahuan serta penekanan tentang isu pembinaan lestari dapat ditingkatkan, kebolehan pelajar untuk mempertimbangkan isu lestari dalam projek mereka dijangka dapat dipertingkatkan. Perbandingan juga dibuat merentasi latar belakang pelajar seperti jantina, pengalaman kerja, kampus dan juga semester pengajian. Instrumen yang dibangunkan boleh digunapakai untuk tujuan pemantauan dan juga perbandingan dengan institut pengajian tinggi lain.

INTEGRATING ENVIRONMENTALLY SUSTAINABLE CONSTRUCTION IN THE ARCHITECTURAL DESIGN EDUCATION AT UNIVERSITI TEKNOLOGI MARA, MALAYSIA

ABSTRACT

The design studio teaching methods is recognised as the foundation of most design curricula as traditionally practiced by Ecole de Beaux Arts and Bauhaus. However it is increasingly being scrutinised as to its effectiveness in shaping future professionals relative to the quality of the built environments. This study proposes an instrument that can be used to numerically assess level of integration of environmentally sustainable construction education in design studios. A survey is conducted using random strata sampling technique among undergraduate students. The instrument is in the form of questionnaire developed using five key environmental sustainability indicators. Since integration is difficult to be measured directly, the five key indicators are expanded into three dimensions of integration that are knowledge acquired, emphasis given by tutors and ability of the students to consider sustainability issues in their design. Cronbach's Alpha values of more than 0.7 for each dimension, suggests satisfactory reliability of the instrument. Data analysis using t-test, ANOVA, and Pearson's correlation test were undertaken It is found that the level of integration at Universiti Teknologi Mara is on the positive side even though not sufficiently high. If the knowledge acquired by the students and the emphasis level by tutors on sustainability issues can be increased, it is strongly believe that the student's ability to consider sustainability issues in their design would also be improved. Comparisons are also made across the respondents' background information such as gender, and prior working experience, campus and semester of study. The proposed instrument can be used for monitoring the progress of integration as well as for comparison with other institutes of higher learning.

CHAPTER 1
INTRODUCTION

1.0 Research Background

It is a well known fact that teaching and learning of architecture is conventionally conducted in design studios. Design studios are places of learning by doing within the tradition of project based or problem based education. This is reflected by its heavy pedagogical and andragogical responsibilities it carries within the architectural education. Ledewitz (1985) emphasises the purpose of the studio in architectural education as to teach architectural design. However, there is increasing evidence in the tremendous diversity of content and methods in the conduct of studio teaching in different schools. These dissimilarities may also be evidenced within one department of the same school.

Despite the educational advantages associated with design studio teaching methodologies, there exist a number of shortcomings. The purpose of design studio teaching sometimes lack clarity and may have conflicting goals. Often, there are vagueness and ambiguity in the brief requirements of a design projects as undertaken in design studios. This is not uncommon in architectural schools all over the world including Malaysia. General observation in schools of architecture around the country points to complexity relating to the running of design studios. Many related technical subjects must be thaught parallel to the design studios for them to properly function. This is why there are various methodologies used in the teaching of studio related subjects such as sustainability and construction (Yunos, 2000).

There often exists, lack of awareness on the relationship between construction, design, social and environmental aspect of architecture such as sustainability in design studio education. This may suggest minimum consideration given on the

abovementioned issues. It may also reflect that there is a clear bias towards design. The subjects of sustainability and construction technology are often thaught as distinct diciplines to design. They may sometimes be limited to isolated topics based on the teachers' knowledge and interest, devoid of the broader perspectives (Hassan et.al, 2007; Ibrahim et.al, 2006, 2007; Yunus, 2000 and Ledewitz, 1985).

There are growing frustrations with the current situation in the design education. Many are voicing their thoughts on the education of future architects. Many argue that current design education are not responsible enough to the social and environmental demands of contemporary societies (Sallingaros et.al 2008; Walker et.al., 2008; Hassan et.al., 2007; Al-Mogren, 2006; Salama,1995, 2002, 2006; Tinker et.al, 2004; Schon, 1984, 1987 and Taylor, 1999). Current issues such as ecologically responsible or sustainable designs must be put in proper perspective. This is because of the ever increasing threat to the global environment. In the context of Malaysia, as a developing country we often based our curricular on earlier conventional models. This models founded by westernised mold may not seems appropriate in the quest for the country to achieve its developed status by 2020.

Salingaros et.al (2008) argues that current architectural education throughout the world no longer provide a credible basis for the discipline and practice of architecture. This is also supported by the likes of Salama & Wilkinson (2007). They offer useful suggestions and criticisms that provide the impetus to overcome the resistance to the status quo. The argument put forward is why are students allowed to copy an international model of architecture that is indifferent even contradictory to the local context? As designers of tomorrow, architecture students of today, must continually strive in an education system that promotes current issues. These issues must be able to serve their immediate context. This is also similar to the principle behind 'Biophillia' (Kellert et.al 2008). 'Biophilia' sees architecture as an extension of biology in that the

environment is healthier for human habitation when the environment itself is compatible with nature. Environmental sustainability must be seen as essential criteria related to future global requirements. Not only must the criteria be identified, their level of integration must also be assessed and its effectiveness evaluated.

With reference to the above, an effort must be made in contributing towards improving the quality of design studio education. This study is an attempt to identify and numerically measure integration level of criteria or indicators related to the following issue:

- Firstly the issue of sustainability has become a global agenda since the Earth Summit in 1992. It is reaffirmed again at the Johannesburg Summit in 2002 (UNESCO: Education 2002, 1). For a country such as Malaysia, it may be prudent to be part of this global movement by promoting sustainability agendas in its architectural design studio curriculum. By doing so it can helps the country to achieve a world class status in its education system. The Prime Minister of Malaysia himself also stated that graduates are the most precious assets to the nation and they must be able to apply holistic or sustainable approach in helping the country's development towards achieving the status of a developed country (Hassan et.al. 2007 and Higher Education Ministry, 2006, xiii).

  The promotion of literacy in sustainable issues within the design studio curriculum should be used in producing model graduates of the future. By doing so the graduates will have better understanding of global issues that would result in more ecologically responsible designs. A much more recent development is the launching of the Malaysia Green Buliding Index (GBI Malaysia) in the second quarter of 2009. GBI Malaysia receives much support from the government through various incentives for the construction industries. This is implemented through the

10th Malaysian Plan (RM-10) and has sparked renewed interest on issues related to sustainability.

- Secondly there has been a lot of development on modern construction methods. Architectural students are now faced with the complexity of choice and greater challenges related to sustainable design. The growth and importance of environmentally sustainable construction is undeniable. To keep up with modern development, construction education must incorporate courses on latest technologies that promote sustainable designs. New technologies will help tackle current needs of the world's population. In developed countries such as the United States, its accrediting agency, the American Council for Construction Education (ACCE) has long included environmental coursework within their approved curriculum. Their ACCE guidelines even mandated that environmental issues be covered as criteria for all project planning.

This may not be the case In Malaysia. The organisation responsible for architectural education in Malaysia is the Council for Architectural Education Malaysia or CAEM and the Board of Architect Malaysia (LAM) which holds the register of architects in Malaysia. The Pertubuhan Arkitek Malaysia (PAM) is a separate entity but related professional body responsible for professional practice and occasionally advises LAM, with its members forming part of the committee of CAEM and LAM. They have their own general sets of criteria of which the issues on sustainability are still in its infancy.

However this could be seen as proof on the need to improve the architectural curriculum nationwide. Students are constantly exposed to varieties of design solutions using newer construction technologies. However the syllabuses that form

the foundation in their understanding on design technologies continue to stay the same with minor updates.

- Thirdly the important roles played by the public universities in the conduct of architectural design studio education in the context of Malaysia. Most of the established schools of architecture in the country are in the recognised public universities. There are also private enterprises which may still be in the process of complying with the various regulations required by the professional bodies in the country. Public universities in Malaysia receive substantial financial commitments from the government. The government sees education as a national policy that results in not only infrastructural support and extensive physical developments. Public universities also attract most of the foreign educated locals and expatriate Masters and PhD holders into becoming part of its academic entities.

1.1 Problem Statements

Sustaining the built environment is already a major issue today. Therefore the task of integrating sustainability in the design education is not to be understated. If the profession is to survive the ever increasing demand of the future, a proper and timely response within the educational setup is surely a must. Douvlou (2006) stressed there is a need to integrate sustainability agenda within the existing design curriculum. This is more so in view of the serious environmental issues facing our graduates in real-world situations. To numerically assess level of integration on environmentally sustainable construction several problems have to be solved.

Firstly, the concept of environmentally sustainable construction is very broad. It is difficult to assess the level of integration of any particular curriculum setup unless we make an attempt to simplify and narrow down the key criteria. These key criteria reflect the students' actual understanding and their ability to translate it into a well developed

design concept. There are scores of literatures that touch on issues of environmental sustainability and design. Rao et.al. (2008) pointed to the development of the students awareness, perceptions and intention. This is done by setting a structured integration of environmental sustainability issues through subjects related to the built environment. Hassan et.al. (2007) discusses issues on students ability to have critical thinking and integrate a holistic approach in environmental awareness such as literacy in sustainable issues and development (SID). Hui (2002) highlighted that there are various viewpoints which illustrate the variety of foci evident in discussing issues on sustainability.

Because of the above broad nature of the subject, this study only focuses on issues related to environmentally sustainable construction. This will be the subject focus related to design studio education in this study. Hence, several key indicators have to be identified and selected that represent environmentally sustainable construction in general. These indicators must be easily accepted and understood by the students themselves.

Secondly, the challenge is how can integration level be measured? Integration level is a value that may not be measured by asking directly especially to students and even their lecturers. This is very similar to research in behavioural science where theoretical constructs cannot be measured directly such as motivation level and verbal skill (Byrne, 2001). Therefore, several dimensions representing students' level of understandings, contents of curriculum and ability to produce design incorporating environmentally sustainable construction have to be identified.

Thirdly, studies by Ibrahim (2008) and Rao (2008) revealed that current architectural programmes do have elements to support the pursuit of sustainability integration while at the same time focusing on artistic pursuit. Ibrahim (2008) also

reveals that there has been noticeable increase of academicians with interest in environmental issues which promise better opportunity for integration. However, there is a crucial need at having numerical data so that improvement can be monitored in a systematic manner.

1.2 Research Questions and Research Objectives

Based on the problem statements discussed in Section 1.1, the main research questions of this study are as follows:

- What are the key indicators that can be used to measure integration level?
- How to measure the integration level based of the selected key indicators?
- What are the levels of their integration within the design studio education?

To answer the above questions we have to define the extent of issues related to environmentally sustainable construction by reviewing existing literatures. The literatures must be related to issues on environmentally sustainable construction. Next is to develop a tool or instrument and finally to quantify the level of integration itself. Thus, the objectives of this study are as follows:

- To identify key indicators related to environmentally sustainable construction using established global sustainability indices by reviewing existing literatures.
- To develop an instrument to measure integration level of environmentally sustainable construction in architectural design studio education based on the key indicators identified.
- To numerically assess the integration level of environmentally sustainable construction using the instrument developed in architectural design education.

1.3 Significance of Research

The main purpose of this study is to investigate the architectural design educational setup. It's teaching and learning styles or methods was looked at. The relevancy of the design studio processes in contributing to environmentally sustainable construction was also determined. The instrument developed from this study was used to assess and monitor the integration level of environmentally sustainable construction within the architectural design education. The result of this study could encourage the architectural design education to be more responsive and effective in empowering students in the area of environmental sustainability.

1.4 Scope and Outline of Research

Universiti Teknologi MARA (UiTM) being one of the oldest universities for the learning of architecture was selected for this study. There are several reasons for this selection:

- UiTM is one of the oldest institutions of higher learning in Malaysia that offers similar architectural programme at two separate campuses.
- Recent positive development seen in the recognition of its architectural programme by the Royal Institute of British Architects (RIBA) for its Bachelor of Architecture (Honours) RIBA (LAM Part.1 and 2 equivalent)
- There have been many revisions done to its architectural curriculum and currently undergoing another review.
- As a teaching staff, it allows easier access to informations regarding to the curriculum for the purpose of this study.

This study is carried out to determine the level of integration on environmentally sustainable construction in architectural design education at Universiti Teknologi MARA (UiTM) in Shah Alam and Perak campuses. Chapter 2 reviews the overall architectural design setups, its characteristics, practices and introduces the current development related to professional, socio-economic and environmental issues. The chapter also discusses basic definition and the needs to integrate environmentally sustainable construction in architectural design education. A brief review of the current curriculums from selected overseas institutions of higher learnings is also undertaken. The chapter ends with a more specific appraisal on the architectural programme as currently offered at UiTM.

Chapter 3 discusses on the established standards or indices for assessing sustainability. A comparative overview of the indices is also undertaken with an evaluation of the Malaysian Green Building Index as the preffered sustainability indicators. This chapter forms the foundation to the final selection of the key environmentally sustainable construction indicators for this study.

In Chapter 4, the research methodology is presented. This includes the development of the instrument to measure integration, sampling design, data collection and method of analysis.

Chapter 5 begins with a test of reliability of the survey instrument, followed by analysis of integration which includes overall comparison of integration level between Perak and Shah Alam campuses. Detailed analysis across students' background variables such as gender, parts of study and work experience are presented for individual campus.

The final Chapter 6 summarises the overall research, discusses the implication towards the architectural design education and proposes some suggestions for future research. Figure 1.1 summarises the scope and framework of this study.

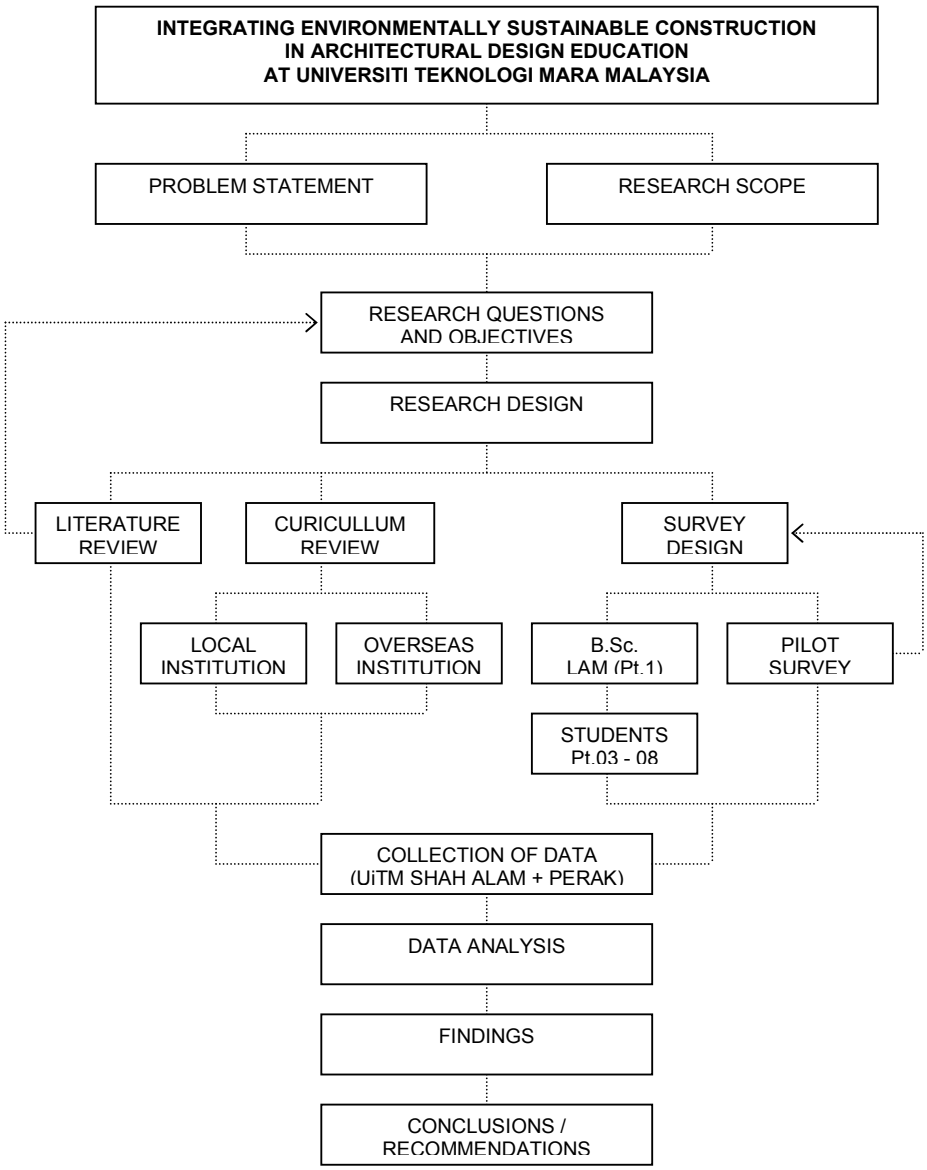

Figure 1.1: Research Flow Chart

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

Many university systems take the view of a more methodical approach based on technical rationality that is based on systematic and scientific knowledge (Salama, 2006; Yunos, 2000 and Gerlenter, 1988). However, according to Schon (1987), there are tensions between proponents of the studio process where intuition and reflection, processes critical to imaginative problem solving are in some conflict with scientific training. This scientific training is frequently derived from rapidly expanding information and knowledge. The systematic and scientific knowledge base maybe insufficient as sometimes observed in general with undergraduate students. However, it is essential and complement the difficult decision making processes in the architectural design studio projects. This chapter basically reviews and discusses existing literatures on the two main areas of focus that are the architectural design education and the subject of environmentally sustainable construction. The architectural design education is discussed from Section 2.1 to Section 2.3 whilst issues on integration of environmentally sustainable construction are covered from Section 2.4 to Section 2.6.

2.1 Architectural Design Education: An Overview.

Architectural design education, like most other types of education, reflects the values of the professions and society at large. The process of design education is said to be interdependent. It is often created in the field of tension between reasons, emotions, intuitions that touches almost everything related to humanism (Salama, 1995). This complexity in dealing with problems and 'designing' the solutions is the very essence of the architectural education. However, there are difficulties faced by many architectural students to bring together the various topics such as technicals and scientific etc. together in relation to the design process.

The architectural design education is mostly centred around and based on series of projects. It is conducted in a manner described as learning by doing or practical work as mentioned by Douvlou (2006). Most architectural design projects are conducted in design studios. The conventional design studio teaching methods is at the core of most design curricula and also as the formal learning setting in the training to become an architect. Students are given a brief, programme or set of requirements from which they are expected to develop a set of proposals that address those requirements. Merger (1998) hinted in most cases time is of essence as most undergraduate courses are structured in a very tight manner leaving very little or no time at all. This is especially for processes such as 'reflection-in-action' and 'reflection-upon-learning' as mentioned by Schon (1984).

Individual learns differently and they vary from one person to the other (Samsuddin, 2008). There are many theories of advanced learning contributed by educational scientists and scholars. Examples are the theories of 'behaviourism' by Pavlov and Skinner (SEP, 2000) and 'learning via self-discovery' which is discussed by Bruner (1973). The 'social theorist' is argued by Vygotsky (1986) whilst learning by doing is related at length by Piaget (1973). 'Constructivism' theory by Dewey (1964) is also highly regarded by educationist. In the study done by Thanasoulas (2002), he states that within the constructivist paradigm, the accent is on the learner rather than the teacher. According to Thanasoulas it is the learners who interacts with his or her environment and thus gains the understanding of its features and characteristics. The learner constructs his own conceptualisations and finds his own solutions to problems, mastering autonomy and independence. If the student is able to perform in a problem solving situation, a meaningful learning will then occur because he has 'constructed' an interpretation of how things work (Thanasoulas, 2002).

Design studio education is also related to an educational pedagogy called ‘experiential-learning’ such as described by Kolb (1984) and Rogers (1994). The tenets of ‘experiential-learning’ are personal involvement, learner initiation and evaluation. This is similar with the concept of ‘situated-learning’ and ‘constructivism’ of the social theorist Vygotsky (1986) and Dewey (1964). In this case the social context is the design studio or classroom. Here, the students can take part in manipulating materials and thus forming a community of learners who construct their knowledge together (Thanasoulas, 2002). Fosnot (1996) provided four basic epistemological assumptions related to “constructivist-learning” which are: knowledge must be physically, symbolically, socially and theoretically constructed by learners themselves. In other word, the student learners are expected to be active participants in learning (design studios) rather than passive recipients of knowledge and information such as found in classrooms.

The American Institute of Architecture Students (AIAS) has comissioned a report in 2002 relating to studio culture that raises several questions. They were about how deeply ingrained attitudes and assumptions can compromise the effectiveness of the studio as a means of teaching and training (Sullivan, 2003). The report also calls for fundamental and commonsense changes to the nature or direction of the design studios.(Sullivan, 2003) The report also made several recommendations such as the studio has to be able to foster a culture of engagement by involving students in multi-diciplinary studies. At the same time the studio culture has to play a more important role in community involvement. This is similar to Salama (1995) who refers to future designers that are socially and ethically responsive, able to function within a given context.

Lawson (1993) revealed that the designer generates ideas and solutions by means of ‘parallel line of thoughts’. This thinking processes takes into account the

'divergent' and 'convergent' modes of thinking. According to Lawson (1993) too, the thought processes and interaction such as with materials and objects are done in an interactive manner. Thus design education process has its own way of thinking, knowing and doing (Samsudin, 2008). A more recent study by Lawson (2006) also emphasised that design is an intellectual culture of its own nature. The design studio differs from the normal classroom environment by its function as the main medium of creative interaction and exploration. Despite its complexity, the studio education is always seen as the essential medium in most, if not all of the architectural curriculums.

2.1.1 Characteristics of Architectural Design Education

As mentioned earlier the studio setting is where most architectural design students learn to visualize graphically, in other word to 'think architecturally'. For this reason, design studios form the heart of most architectural curricula (Attoe, 1991). Studios are usually large rooms sometimes equipped with workstations most often consist of drafting tables. Whilst lectures do takes place in studios, they are in stark contrast to the traditional classrooms teaching techniques.

Studio sessions are often run in the form of seminars, workshops or forums with presentations conducted by both students and tutors. The sessions are overseen by a studio master who acts as the coordinator to the overall teaching methodology. The studio master is assisted by several tutors as the projects progresses. Studio sessions are often forums for students to exchange ideas and interact with one another. Students will directly and indirectly participate in 'critique' sessions prior to arriving at the solutions to the design 'problems' (the brief). Criticism is one of the main pedagogical technique or characteristics used in design studios education (Attoe, 1991). Students will engage themselves in conversations be it formal or informal, making oral communication essential as a trait in design exploration. Dannels (2005),

Anthony (1991) and Morton (2005) recognised this fact as a significant ritual and a rite of passage in the design studio education.

Another characteristic of design studio experience is synthesis or the ability to bring things together. According to Attoe (1991) typically an architectural 'problem' is presented and information related to the 'problem' is made available. The students then undertake the sometimes lengthy and often frustrating process of 'finding' the 'solution'. The tutors will 'talk' at length or 'guide' the students during this problem-solving or synthesising process. This studio experience encourages students to seek out the information and brings things together (systhesis) in solving the design problems. This is comparable to Allen (1980) who refers to the design studios as real-life experience condensed into manageable amount of time and space. Allen (1980) also regarded design studios as an open laboratory. It is where students are involved in the most natural and most productive way of learning.

In another study, Ledewitz (1985) highlighted that the main characteristic of the studio in architectural education, is to teach architectural design. It is also a place where students are involved in a way of thinking and learning (Maitland, 1991). The studio is thus, the primary means of teaching basic aspects of design education, where students learn a new language. This new language can be traced to the graphic and verbal language game as mentioned by Schon (1981). This language involves drawing and talking that is complementary and linked with a situation where students learn to 'think architecturally'. There is also tremendous diversity of contents and methods in studio teaching in different schools and even within one department (Ledewitz, 1985). As the studio is the primary means of teaching basic aspects of design education, it is where students learn and practice new skills, such as visualisation and representation. Ledewitz (1985) stated that educationists too have long recognised and can easily

distinguish those students who have acquired the ability to 'think architecturally' and think creatively from those who have not.

Clearly, design studio inspite of the growth and development in technology is still the traditional arts and crafts endeavour blended with some intuition and reflection (Green, 2003). Douvlou (2006) realised that the implementation of such teaching techniques which so characterised the design studios is not an easy task. The diverse students' background with no prior design experience may also affect the effectiveness in experiencing the learning process. These traditional approaches commonly characterized many of the current design studios. They often follow principles and practices developed in the past. However, these practices may not be sufficent to prepare the learners to deal with realities of contemporary societies in a more responsive and responsible manner.

2.1.2 Architectural Design as a Creative Thinking Process

For so long creativity has been regarded as central to the practice of artistic, inventors and musicians. Many literatures describe the ever evolving concept of creativity such as the one that refers to the subject matter relating to design methods (Lawson, 1990 and Cuff, 1991). In a study by Jones (1970), a rudimentary observation was made in that creativity is seen as essential tool for the integration of genious and responsibility. Lawson (1990) too supported the above notion by generally accepting that design as a creative preoccupation of good designers producing creative works. Thus, creativity in design often requires a balance of 'convergent' and 'divergent' thinking modes (Guilford, 1967). Both may occurs in a 'parallel line of thoughts' as described by Lawson (1993). The situation (design) will establish which mode is dominant. This is argued by Lawson (2006) in that science cannot be exclusively regarded as convergent thinking nor can design requires only divergent thinking. These thinking modes has similarity to other dualism such as suggested by De Bono (1970)

on ‘vertical’ and ‘lateral thinking’ and by Tovey (1984) which discusses the brain as ‘left’ and right ‘hemisphere’. Design studio is also a place where creativity is nurtured and problem solved by thinking widely and deeply using much of the right side of the brain. This is in contrast to other technical engineering and sciences disciplines (Green, 2003).

Creative thinking therefore, is one of the prerequisites in the design studio education. Creative thinking also allows design to be objectively, socially and creatively created. Creative design solutions allow the making of meaningful architectures that incorporate issues such as socio-economy and environment. However a balance is needed in the architectural design education between creativity as an artistic paradigm and responsibility as a social paradigm (Salama, 1995). Architectural design education is thus the best platform to foster this creativity process towards the good of society and environment as a whole.

2.1.3 Architectural Design as Problem Based Learning (PBL) process

Design studio is also commonly recognised as a ‘problem-based learning’ or PBL process where student activities are centred within a series of projects (‘problem’) and scenarios. Students normally work on a simulated real life design brief and in doing so, will be exposed to a wide range of issues relating to the design brief. It is here that the students normally develop their intuition, creativity and other skills that is their ability to design. The different between traditional learning and studio learning is that students will explore by means of activities such as discussion, presentations and model making around the series of ‘problem’. This is different from the direct transfer technique as in most lecture classes. This is why PBL is generally refers to as a holistic structuring of the curriculum that includes factors often contradictory in itself such as environmental, cultural and philosophy (Roberts, 2004).

Cross (1977) suggested that to design therefore is to tackle a unique type of problem, which in a sense similar to problem solving. However, Roberts (2004) suggests that there is this misperception that arises because 'problem based learning' is not to be confused with problem solving. According to Roberts (2004) problem solving only involve the derivation of a single correct answer from a pre-defined problem using formulaic process. Roberts (2004) stated that a typical design project does not seek a single correct answer, rather the learners are encouraged to propose several speculative and exploratory design solutions. Thus, the student responses are likely to be unique and specific in nature eventhough there is the inclination towards subjectivity. This is stated earlier by Schon (1983) who argued that this is the results of intuitions with the application of a rational body of knowledge.

Brawne (1995) reaffirmed by reiterating that though the responses may be unique or specific there are situations where the designs will remain open ended and vague. This perhaps was why Roberts (2004) identified on design studios education as a place where students learn to make propositions rather than to solve them. This may be the reason why design studio education is often seen as an enjoyable and effective way of learning critical design skills characterised by the PBL methods.

2.2 Development of the Architectural Design Education

The architectural design studio has its roots from the practices of apprentices (or skill training whilst working for an employer) in the atelier or artist studio. The first thing anyone intending to study architecture had to do was to join an atelier (Carlhian, 1979). This system also similar to the guilds of the middle ages which primarily centred on the arts and crafts activities of the master craftsman. Young talented apprentices worked while learning the skills from their masters (Lackney, 1999). This apprenticeship model is not dissimilar with the models advocated by the Beaux-Arts' (fine arts) educational system in seventeenth century France. The academic curricula

of the Bauhaus (school of building that incorporate arts and crafts) were then set up after World War I in Germany. Historicaly Ecole Des Beaux Arts (school of fine arts) and the Bauhaus were the two most important design education models and that their influences to the many architectural schools throughout the world are still present until today. However they are not without criticism.

Because of the many criticism, there are numerous variation to the education systems and principles as pioneered by Beaux Arts and Bauhaus. Studies by Cuff (1991), Lawson (1990, 2006), Gerlenter (1988), Salama (1995, 2002, 2006, 2007), Hassan (2007) and Samsudin (2008) are examples of development which are critical of the traditional education systems. Salama (1995) has been notable on this issue. He argues that the various methodologies of the design studio education is non satisfactory. According to him current methods and approach follows past principles that are not sufficient to meet the need of contemporary and future societies. Sanoff (1995) added that the effectiveness of the architectural education can be assessed by the quality of current built enviroment. It can also be judged by the way in which the public perceives and values the contribution of designers. In spite of the many contributions over the years by the architectural design education there is still a need for a paradigm shift in meeting the challenges of the future (Cuff, 1991; Salama, 1995; Yunos, 2000; Hassan, 2007 and Samsudin, 2008).

2.3 The Professional, Socio-economic and Environmental Consequences of the Architectural Design Education

The architectural design education is without doubt the foundation to the profession of architecture. Architecture forms an important part of many human endeavours. Sanoff (1985) argues the effectiveness of the architectural education is constantly being scrutinized. The designer's ability to affect meaningful changes to the physical environment that we live in today is also being critically appraised. There are

gaps between architectural design education and the practice of architecture which results in numerous pitfalls and problems for the environments (Yunos, 2000 and Sanoff, 1995). Traditionally the method of design solution was intuition that relied upon the designers or artists' experience and judgement. Nonetheless the decisions that produced noteworthy physical environment of previous generations may not suit the current socio-economic and environmental challenges (Salama, 1985 and Sanoff, 1985).

Architects are often acknowledged as products of the current architectural design education. They are the key players within the building industry. They are in the best position to promote and impart positive values and ideologies to the society. Issues such as socio-economic and environmental are critical to the development of future built environments. Despite these responsibilities the lure of commercial profits and the various economic reasons has become hindrances and the number one priority in order to just survive. This has placed great pressure on the practice of architecture in particular within the building industries. Consequently this affects the socio-economic and environmental balance of the overall physical development. Ibrahim (2008) noted several studies related to this as being the consequences of the lack of knowledge among architects on issues such as social and environments (Franz, 1998 and Ibrahim, 2001).

In another study by Ibrahim (2003), reveals there is complacency among local graduates which were the products of the current architectural design education. According to her the architectural graduates when put into practice seems unable to face the complex multifaceted situations in responding to the demands of the industries. This consequently impacted the built environment considerably.

Educationist such as Ledewitz (1985) stated that those were the results of problems in architectural schools such as insufficient technical knowledge observed within their designs. Ledewitz (1985) reiterates that students often lack the ability to integrate theories and the pragmatic aspects of the project. Students are often influenced by architectural forms and styles found so often in glossy periodicals. These unfortunately compel them to emulate without realising the fundamental reasons behind such forms as intended by its designers. This has resulted in physical forms being designed only through artistic notions and expressions. They are often based on the individual designers' beliefs rather than the broader human needs such as social and environmental concerns (Salama, 1995).

Rao, et.al. (2008) pointed out that the integration of environmental issues in design considerations must go beyond the rhetorics. This is because many catasthrophic environmental consequences and problems that occur clearly reflect the imbalance between theory and practice. Many architectural educationists believe all these setbacks and damage to the environment are very costly. The collective responsibility is on the part of the current architectural education. The education system must inculcate environmental awareness to all students as early as possible during their formative years as undergraduates (Salama, 1995; Johnson, 1995; Yunos, 2000; Rahman, 2004; Hassan, 2007 and Rao, 2008).

2.4 Environmentally Sustainable Construction and its Integration in the Architectural Design Education

Architectural design education is similar to issues on environmentally sustainable construction which is by nature interdisciplinary. Environmental sustainability is interdependent and exists within a larger field (Reid, 1988). As a result, more effort need to be made in the integration based curriculum in order to equip graduates to face future challenges. However in almost all school of architecture the

principle methods in teaching of construction and technology is by means of formal classroom lectures. Gelerntner (1988:46) revealed that the essential concepts of teaching construction does not seems to show up in the students design projects; since these 'lectures' are often treated as separate courses with their own schedules and timings.

Often very little attempt to coordinate the on-going projects with the construction assignments is made. This has resulted in the impression that design process is merely concerned only with the creative aspect devoid of any technical inputs whatsoever. The duration of time allocated to technical discussions during tutorials within the studio sessions seems insignificant in relations to creative designs. This is a rather distressing situation as many of the graduating students would go out to work in practices in the hope of acquiring the 'rest' of the technical knowledge outside of academia.

In a related study by Yunos (2000) on schools of architecture in Malaysia, she discovered that there is very little effort exerted to coordinate on-going design projects with construction assignments. This is consistent with Hassan (2007) who stated that current focus on education of sustainable issues may not be coordinated in a systematic manner that is able to expose students to broader environmental perspectives.

This lack of awareness on the relationship between construction, design and environmental aspects within the studio education may suggest that there is too much bias towards design and very little on sustainability issues. In line with the above this study will focus on the environmentally sustainable construction aspects of the architectural design education. It is hoped that this will help to produce a more holistic graduate (Hassan, 2007) that have the necessary capabilities to incorporate green philosophies and techniques (Tinker, et.al., 2004). As sustaining the built environment

is already a major issue today, the task of integrating sustainability in the architectural design education should not be understated.

2.4.1 Definition of Sustainability and Concept of Environmentally Sustainable Construction

Sustainability is undoubtedly an extensive issue and there are many definitions regarding sustainability. Based on Webster Dictionary (1991) sustainability is defined as the ability to endure without giving way or yielding. Specifically this means the ability of the environment to withstands the 'undeserved punishment' set upon it by mankind and all living beings will determine the nature or state of the environment in years to come. Johnson (1996) defines sustainability as being rooted in a spirit of cooperation and commitment to utilise technology in a morally and socially responsible manner so that buildings and cities nurture human spirit and fully respect nature.

According to Salama (1995), sustainability is envisioned as a state in which all humans, now and in the future can live at a decent level of well being within the limits of what nature can and continue to provide. To create sustainable architecture the designer must holistically combine the knowledge of the new with that the old. This will result in a built environment that respects culture, environment and history of the inhabitants. Wright (2003) in his article also reached similar conclusion in that sustainability has been identified as the core issue of architecture. To reflect on this notion, he further emphasised that sustainability will need to be integrated into the architecture curriculum. Mendler (2006) too arrived at similar findings in that nature plays a very crucial role in sustainability; for it is efficient and effective in design producing essentially zero waste.

Perhaps the more familiar and widely used definition today is the one developed by The United Nations Commission on Environment and Development (The

Bruntland Commission) which contends that, sustainable development is a process that 'meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission, 1987).

However in contrast to nature, we designers often make use of our natural resources, producing and utilising energy and at the same time creating waste in almost every step of the design process. This common practice is associated with what is termed according to Mendler (2006) as a 'linear' process which is non sustainable. This is opposed to the 'cyclical' model that integrate health, safety, comfort and ecology in its consideration (Figure 2.1). This makes the ability to recycle i.e. zero waste as in nature, as the main agenda. The goals of sustainability must be met by means of sustainable design and sustainable construction contributed by designers and educators. Sustainability must take into account a process that is restorative, regenerative, dynamic and efficient as opposed to energy intensive, resource dependent, extractive and disposable methods (Mendler, 2006).

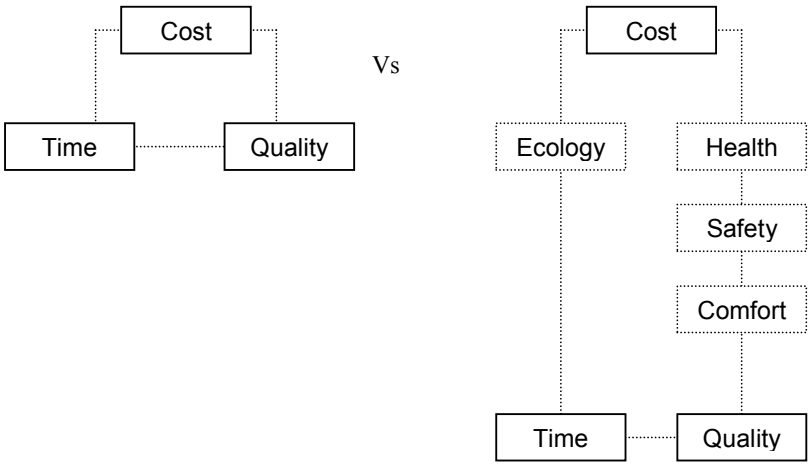

Figure 2.1: Traditional considerations versus Ecological ones.
(Source: Mendler, 2006)

The process of design involves using the right materials and construction techniques to achieve sustainability. In design education; concept and idea must go hand in hand with choice of materials, techniques of construction and assembly methods. Tinker (2004) contends a separate definition regarding sustainable construction as those materials and methods used to construct and maintain a structure that meets the needs of the present without compromising the ability of future generations to meet their own needs. Hui (2002) defines sustainable construction as the creation and responsible management of a healthy built environment based on resource efficient and ecological principles. This includes minimizing non-renewable resources, enhancing the natural environment and eliminating the use of toxins with the aim to lessen their impact on the environment.

Design and construction of buildings as ecological process makes good sense and seen as the right things to do (Orr, 2008). Sustainable construction should consider the role of ecological systems, in a more synergistic manner by integration of ecological considerations with the built environment in a resource conscious manner (Kibert, 2008). This is to complement the complex technologies in use today such as to control building energy usage, waste production and stormwater recycling. Kibert (2008) also defines green building as the actual structure created using materials and principles of sustainable construction, built in a resource efficient manner using ecologically based materials. This is not dissimilar with the concept of ecologically sustainable design that utilizes renewable energy concept. According to Kibert (2008) also, the problem arises when we try to partition and comparmentalise our thoughts and thinking and try to define the various terminologies within a limited scope.