# Design Studio as Problem Based Learning in Architectural Education in Universiti Teknologi Malaysia

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**Abstract**

This paper presents confirmation of teaching methods employed in a sustainable design studio in Universiti Teknologi Malaysia. Quantitative method was employed where 25 Questionnaires were distributed to 5th year students and analysed using SPSS. The result found that the lecturers used various methods in teaching design studio but sustainable design issue was not of priority. Sustainability issue is mostly considered in elective subjects so sustainable ideas was not emphasized in design studio. Only students that offer the courses get acquainted with the issue of sustainability. Design studio can be Problem Based Learning as both have the same process and characteristics.

*Keywords:* Pedagogy, architectural education, problem based learning;

## 1. Introduction

### Defining Education

The term Education has been defined by different scholars and philosophers. Hence, there is no unique definition of education as the concept has been exposed to different and often contradictory interpretations. Ducasse, (1958) noted that it comes from the Latin word "educere" meaning to 'lead out', or 'bring out'. But another school of thought denied that rather is "educare", which means to 'form' or 'train' (Schofield, 1972). Thus, with the coming of industrialism, and the increase in demand for knowledge and skills, 'education' became increasingly associated with 'schooling' and with the sort of training and instruction that went on in special instructions. The UNESCO International Standard Classification of Education (1995) defines education as comprising organized and sustained communication designed to bring about learning. The words communication, organized, sustained and learning are further explained, communication require a relationship between two or more people involving the transfer of information, 'organised' means planned in a sequence with established aims and curricular. 'Sustained' means the learning experience has to mean any change in behavior knowledge, understanding, skills or capabilities which the learner retains and which cannot be ascribed simply to physical growth or to the development of inherited behavior pattern (Thompson, 1981). Another definition by Fafunwa (1982) is that education is the aggregate of all the processes by which a child or young adult develops ability, attitudes and other forms of behavior which of positive value to the society in which he live. And Balogun, (2008) refers education to any act or experience that has a formative effect on the mind, character or physical ability of an individual. He further explained that education is a life-long process in what we continue to learn from experience throughout our lives.

## 2. Architectural Education

Architectural education is concerned with developing students in order for them to become well rounded, competent and imaginative designers of buildings and the spaces between them (Roberts, 2005). Architectural education in general and design studios in particular hold vast potential as a model for integrated learning. "It is a process, a way of thinking during which the many elements, possibilities, and constraints of architectural knowledge are integrated. Design studio sequence provides the connective tissue that brings together, progressively, the many elements of architectural education" (Siddiqi, 2002). Understanding the identity of this "subject" is the main part of the pedagogical approach if one hopes to reach the student while addressing relevant issues of architectural education (Yagiz & Dagli, 2001).

The "Reflective Practitioner" philosophy of Schon (1983) focused particularly on architectural and engineering education, was developed from Bauhaus principles and led initially to the introduction of "Problem-Based Learning". A variation on a combination of Schon's and Woods' (1985) themes was a "cognitive apprentice" model (also called "Problem-Based Learning"). This, in turn, was further adapted to architecture and design studio.

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## 3. Pedagogy in Architecture

Academically, architecture is in fact itself pedagogy and each building have their own embedded hidden curriculum that can greatly influence and affect learning process. However, architectural education itself is severely criticized for not providing competent architects to the architectural profession. The built environment and the landscape can be a powerful tool of learning, in this regard the campus as a whole should be regarded as a place where learning occurs. There has been—and still is —a continuous debate among architects and architectural educators about the role of knowledge and research in architecture as a discipline and profession (Salama, 1996 & Sutton, 1984). Whether in developed or developing countries, many in architecture still think of researchers as people in white smocks and thick glasses searching for the mystery and the unknown. In response, scholars and educators have emphasized that research should be viewed as part of everyday actions and experiences.

Schon, (1985) analysed in detail on the issue of studio by examining the dialogue between instructors and design students, he has created a concept of "reflection in action" that is the ability of students to think about what they do and their effect on the time they make it. Schon and Wiggins, (1992) also stated that the design process involves a dialogue between designers and their design. This concept of "Reflection in action" has been used not only in architecture but also it has been popular in other professional fields such as engineering, medicine and the law. Cross (1982) also with the wise and inspired term "Designerly way of knowing" that a designer can be an expert when have been repeatedly made training in design until the designer know what good and not in the design

Salama, (2010) stated that Pedagogy in Architecture has both positive and negative tendencies the negative tendencies are that design concept and finishing is what is expected from the student. The finish product is what matter the process the student arrived at it is of no concern. The students are been rewarded based on the best looking project; this is because there is no clear cut goals and objectives from the beginning of the design approach and the instructors assume the master and students have to believe the master approach. While the positive tendencies are discussions are encourage and the transformation of student and permits learning about the process of changes in a dynamic environment.

Several education theorists including Kolb, (1984) voiced the opinion that experience should be an integral component of any teaching/learning process. Their work can be traced back to the famous dictum of Confucius around 450 BC “Tell me and I will forget. Show me and I may remember. Involve me and I will understand.” Experiential learning refers to learning in which the learner is directly in touch with the realities being studied (Keeton &Tate, 1978). It is contrasted with learning in which the learner only reads about, hears about, talks about, writes about these realities, but never comes in contact with as part of the learning process. Mistakenly, some educators equate experiential learning only with “off campus” or “non-classroom” learning.

However, in architectural pedagogy a class in history or theory of architecture might incorporate periods of student practice on theory exercises and critical thinking problems rather than consisting entirely of lectures about theories of architecture and the work of famous architects (O’Reilly, 1999; and Salama & O’Reilly, 2002).

Learning through experience involves not merely observing the phenomenon being studied but also doing something with it, such as testing its dynamics to learn more about it, or applying a theory learned about it to achieve some desired results (Keeton &Tate, 1978).

Evaluation as a valuable research vehicle needs to be introduced both in lecture courses and design studios, establishing a knowledge base about the built environment that has the capability of endowing students with more control over their learning, knowledge acquisition, and design actions and decisions (Salama,1999).

Habraken (2003) argues that: We need to teach knowledge about everyday environment. How it is structured, what we can learn from historic and contemporary evidence, how different examples compare, how it behaves over time and responds to change of inhabitation or other circumstances. Teaching architecture without teaching how everyday environment works is like teaching medical students the art of healing without telling them how the human body functions. You would not trust a medical doctor who does not know the human body. Knowledge of everyday environment must legitimize our profession.

## 4. History of Problem Based Learning in Brief

PBL was first applied in business schools (Kwan, 2000), but it gained popularity when McMaster University, Canada started to implement the method as its major learning approach in its Medical faculty in the late 1960’s (Schwartzz, Mennin, & Webb, 2001). The Medical faculty in the McMaster University has been using PBL for more than three decades. Having been recognized as an innovative educational approach and shown to have the potential to enhance the education process and its outcomes (Fadzidah, 2006). PBL has gradually been adopted by others. An important innovative aspect of PBL is the shift from teaching to learning. In PBL the learning process is initiated by a problem. Students are requested to discuss problem situations from professional practice among themselves raising questions that can be turned in to learning goals. The main task of the teacher is to facilitate the learning process instead of transfer of knowledge. Students are asked to analyze problems, before knowledge is activated. They are motivated to find answers to their own learning goals by means of independent study activities. The knowledge gained in this method is easier to retrieve that knowledge in practical cases (Banerjee & Graaff, 1996). There may or may not be a total ban on lecturing, the problems may vary in length or form, specific direction may be added to the case, and the facilitating role of the tutor may vary from just supervising the process to chairing each meeting and providing expertise and to facilitate group process by modeling higher order thinking and challenging the thinking of learners (Boud, 1985 &Woods, 1994).

## 5. Problem Based Learning

Problem based learning (PBL) has become increasingly popular in the tertiary education levels of many professional disciplines (Fadzidah, 2006). It is claimed to have maximum effectiveness in producing professional competencies among graduates, but its effectiveness in architectural education has never been thoroughly scrutinized. There is limited research and discussion on pedagogical approaches in architectural education, simply because it is considered as one of the "unimportant" areas that researchers "do not bother studying" (Teymur, 2001).

Since education is the least popular research topic in schools of architecture and strikingly research on architectural education has not been of concern to many academics (Salama, 2004), architectural education itself is severely criticized for not providing competent architects to the architectural profession (Fadzidah, 2006). This criticism is generated from the problems encountered within architectural education itself, where the lack of a formal theoretical framework leads to a disaggregated body of architectural knowledge (Nicol & Pilling, 2000). As such, the architectural education system is desperately in need of solutions to tackle such problems encountered (Moore, 2001 & Brown, 2002).

As PBL has been known to provide competent graduates in many other professional disciplines, there have been attempts to utilize the same pedagogical approach in architectural education as well. Here, PBL is seen as a potential solution to the problems encountered in architectural education. This is particularly the case with its pedagogical mechanism that is believed to provide learners with lifelong learning skills essential for future competency in professional practice (Gibbings, et al. 2008 & Polanco, et al. 2004). But Norman &Schmidt, (1992) argued that PBL appeared to sometimes reduce learning initially but over longer periods encouraged increased retention of knowledge and appeared to contribute to improved motivation and skills for self-directed learning.

PBL five common characteristics:

1. The starting point for learning is a problem (that is, a stimulus for which an individual lacks a ready response).
2. The problem is one that students are apt to face as future professionals.
3. The knowledge that students are expected to acquire during their professional training is organized around problems rather than the disciplines.
4. Students, individually and collectively, assume a major responsibility for their own instruction and learning.
5. Most of the learning occurs within the context of small groups rather than lectures (Bridges,1992).

## 6. PBL in Tertiary Education and Practice in Architectural Education

Problem based learning (PBL) is becoming an increasingly popular term in tertiary education (Kwan, 2000) as more and more educational disciplines implement the teaching and learning approach associated with the terminology. Previously believed to be monopolized by medical schools, PBL applies widely to learning in most professional schools and disciplines. In fact, some argue that it is the most significant innovation since the move of professional training into educational institutions (Fadzidah, 2006). PBL in architectural courses is usually confined to the studio and does not affect or interact with the teaching of other subjects in the curriculum (Maitland, 1997). Critical thinking, self-reflection, interdisciplinary and self-directed learning, and ill-structured problems are central to both PBL and design studio. Korydon suggests that learning outcomes, positive student attitudes, and student motivation increase in the problem-based environment when courses/curricula begin with a comprehensive tutorial session which contextualizes the PBL environment. It is in the opinion of the author that studio instructors must develop more numerous and more formalized group learning activities. The project-based environment—whether termed "PBL" or "design studio"—is being sought after for its core values: fostering critical thinking, cultivating collaborative skills, and inciting life-long learning Korydon (2005). Despite recent critiques of the long-standing traditions of the architectural design studio, it is difficult to imagine an alternative system of learning. The project-based environment is all too synonymous with the profession and practice of architecture Aaron, (2002). The design projects faced in architectural studios—whether in firms or in schools—are complex "problems" that require creativity, speculation, and self-criticism. Problem-based learning is the design process; "we cannot design without inherently thinking and working in a problem-solving mode" (Wayne, 2003).

## 7. Method

The method used for this study was quantitative and the data was analysed using SPSS, 25 Questionnaires were distributed to 5$^{th}$ year students. This study was done to reconfirm the studio pedagogy used by Architectural educators to teach sustainable design components in Universiti Teknologi Malaysia. The pedagogies used in this study were gotten from the interview conducted to the educators and the result has been published in Energy and Environmental Engineering Journal.

The study used fifth year students because they were in their final year and they have gone through all the studios required before graduating. 23 questionnaires were retrieved and were analyzed using SPSS and the reliability test for the questionnaire was also carried out as shown in Table 1 below.

## 8. Result and Discussion

The results of the questionnaires distributed to the 5th year students were as follows: In section A of the questionnaire, the sex shows that males were 12 and females were 11. 12 of the respondents were aged between 21-24 with highest % of 52.2%, while 10 were between 25-28years with 43.5% and only one was above 29 years. All of the respondents were full time students, 8 of them were from rural and 15 from urban. The house type of the respondents are: 12 from terrace, 3 from village, 3 from bungalow, 3 from duplex, 1 from low rise another 1 from multilevel. Only one of the respondents was not IT literate but the rest of 22 were IT literate. The respondents use different software for their design such as: CADD, sketch up, Photoshop, Revit, Artlantis, Vue, and Lumion.

To elicit consistent and reliable response for all the sections on Likert's scale, the Cronbach's Alpha- a tool for measuring the reliability or internal consistency of a psychometric test score was determined through SPSS. These Sections are B, C and E. The Alpha coefficient ranges in value from 0 to 1 in order to describe the reliability of the scale (Reynaldo and Santos, 1999) on the rating scale of 1= never to 5= very often in section B, 1= poor to 5= excellent in Section C and 1= strongly disagree to 5= strongly agree in Section E. The nearer to 1, that is the higher the score, the more reliable the measuring scale and the internal consistency. The generally accepted score is 0.7 (Cronbach, 1951), however, a lower threshold could sometimes be used in research if it falls between 0.6 and 0.7 (Cronbach, 1951; and Cronbach & Shavelson, 2004).

Table 1. Reliability test of the Questionnaire

| SECTION | NO. OF ITEMS | CRONBACH ALPHA | REMARK |
|---|---|---|---|
| **A** | 7 | Demographic profile | - |
| **B** | 8 | 0.768 | Consistent |
| **C** | 8 | 0.778 | Consistent |
| **D** | 10 | Information sources | - |
| **E** | 10 | 0.240 | Not Consistent |

Source: Researcher's field work, 2012

From the Cronbach alpha it shows that section B & C are reliable because there is consistency in the mean of variables tested. But the Cronbach alpha for the section E shows that is not reliable because is less than 0.6, so the questions on the section should be deleted or improved upon. The cause of the problem was because the curriculum does not deal with sustainable design issue effectively. The section can be repeated when the new curriculum is being implemented to confirm the effectiveness. Reliability test for the other sections were not run because there was no frequency needed.

Section D of the questionnaire was for the students to list other sources of components of sustainable design in which they listed the following: Internet, TV, Library, Books, Case study, Site Visits, Architectural Magazines, Catalogues, GBI, UAC, Nippon, GDB, Architect Firm, Lecturers, Movies, Existing Architectural works, Forum and Articles.

Table 2. Section B showing measurement of the pedagogy used by lecturers

| Pedagogy used in teaching | Mean | Std. Deviation | Ranking |
|---|---|---|---|
| **Interactive medium** | 2.5217 | .79026 | 4th |
| **Lectures** | 2.3478 | .98205 | 5th |
| **Scale models** | 3.3043 | 1.06322 | 1st |
| **Case studies** | 2.2174 | .85048 | 6th |
| **Discussion during design process** | 2.0870 | .66831 | 7th |
| **Crit (table, open ,formal & by appointment)** | 2.0435 | .82453 | 8th |
| **Fieldtrip** | 2.8696 | 1.05763 | 3rd |
| **Site visits** | 2.9565 | 1.10693 | 2nd |

Source: Researcher's field work, 2012

Table 3. Section C Measuring how effective the formats used by lecturers in teaching

| Formats used in teaching | Mean | Std. Deviation | Ranking |
|---|---|---|---|
| **Interactive medium** | 2.5217 | .73048 | 3rd |

| | | | |
|---|---|---|---|
| **Lectures** | 2.5652 | .72777 | 2nd |
| **Scale models** | 2.8261 | 1.07247 | 1st |
| **Case studies** | 2.2174 | 1.04257 | 5th |
| **Discussion during design process** | 2.1739 | .93673 | 6th |
| **Crit(Table, open, formal & by appointment)** | 2.1739 | .93673 | 6th |
| **Fieldtrip** | 2.3913 | 1.23359 | 4th |
| **Site visits** | 2.5217 | 1.23838 | 3rd |

Source: Researcher's field work, 2012

Table 4. Section E measuring the understanding of sustainable design components

| Sustainable design components | Mean | Std. Deviation |
|---|---|---|
| **Have been taught about sustainable design** | 2.3043 | .55880 |
| **Building using more artificial light is considered sustainable** | 3.7391 | .91539 |
| **Rain water harvest is an active component of sustainable design** | 2.4783 | .94722 |
| **Different wall & roof sprays can help energy efficient building** | 2.3478 | .77511 |
| **Maximize shape of design to reduce harsh element of climate** | 2.5652 | .78775 |
| **Building orientation to face north or south** | 2.1304 | .75705 |
| **University encourages sustainable design when choosing project or thesis topic** | 2.4348 | .66237 |
| **Fully involved in sustainable design** | 2.6957 | .70290 |
| **Department has specific activity related to sustainable design** | 2.9565 | 1.10693 |
| **Establishment of interdisciplinary and multidisciplinary structures by the university** | 2.6087 | .65638 |

Source: Researcher's field work, 2012

## 9. Conclusion

- In summary it was found that the lecturers use Scale models, site visits, field trip, interactive medium, lectures, case studies, discussion and crit as their studio pedagogy.
- Section C shows pedagogy used in ranking order highest to lowest Scale models, lectures, interactive medium, site visits, fieldtrip, case studies, crit and discussion.
- Section D shows the sources of sustainable design components as: Internet, TV, Library, Books, Case study, Site Visits, Architectural Magazines, Catalogues, GBI, UAC, Nippon, GDB, Architect Firm, Lecturers, Movies, Existing Architectural works, Forum and Articles.
- Section E reveals that students finds it difficult to comprehend with sustainable design question asked because the analysis of this section has a Cronbach's alpha of (0.240) due to sustainable design courses are taken as elective not core courses.

This study suggests Design studio itself can be classified as PBL, for the reason that design studio has the same characteristics of PBL as pointed out by Bridges, (1992). Other researchers also probably classified design studio as PBL seeing that both requires critical thinking, self-reflection, interdisciplinary, self-directed learning and ill-structured problems (Schon, woods,1985, Aaron, 2002, Wayne, 2003, and Korydon, 2005).

The paper concludes that architectural educators in Universiti Teknologi Malaysia do not use problem based learning as a major learning approach as done by other schools like Technical University Delft at Netherlands and University of Newcastle, Australia. But it is been used in such as a quick approach in form of experiment, Such as the day lighting experiment which is done by the students to solve day lighting problems. This experiment will help them throughout their life as architects to solve problems in day lighting cases. The study confirmed that the lecturers used various methods in teaching sustainable design. However, due to the curriculum deals with sustainable design courses as elective not core courses. So students find it difficult to apply sustainable design ideas into their studio design, since is not all students that offer the courses.

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