

The awareness of environmental issues in design among
architectural undergraduates students in Universiti Teknologi Malaysia

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Abstract

This paper reports on survey result on the level of awareness in environmental issues among undergraduate architectural students in Universiti Teknologi Malaysia, UTM. This research focus on the basic environmental issues which includes climatic elements such as sun, wind and light; energy conscious in buildings and environmental friendly building design. The aim is to identify students awareness in environmental issues in their design projects. Results indicate that the level of awareness among students are high. In average more than 80% believe that climate can be the form giver to building design. More than 90% of the students agree that environmental issues, climatic elements and environmental sciences subject are important to designing. However, more than 50% of the students lack knowledge on current environmental issues. Contrast to that, more than 80% of the students in the upper years (4th and 6th year) agree that CAAD software and other software are important to enhance the environmental issues in their design. This paper suggest some future direction in the implementation of environmental issues in design among architectural students.

Keyword: architectural education, environmental design education, environmental design issues, environmental design software

INTRODUCTION

Environmental Issues In Architectural Education

The oil crisis of the early 70's has led in major development in various field of interest particularly alternatives source of energy and renewable energy. Apart from that, the oil crisis also affects others fields, among others is the increased momentum in the development of passive solar and low energy architecture, green or sustainable architecture. Since then, energy and environmental sciences has been a forefront in the development of architecture thinking. In the US, COTE; *Committee of the Environment*, one of the committee in AIA; *American Institute of Architecture*, has been active since 1980's, leading and coordinating the architect's involvement

in environmental and energy related issues as well as promoting the role of architects in preserving and protecting the planet from environmental damage (Gould, K et al, 2006). One of the aims of COTE is to promote and support the integration of sustainable design and ecological literacy in architecture education and practice as the key to the future of the profession and the planet. Similarly, in the UK, SIG; *Sustainability Special Interest Group (Architectural Education)* under the CEBE; *Centre for Education in the Built Environment* which researched the learning and teaching of sustainability across the curriculum and in undergraduate and postgraduate courses in UK Schools of Architecture (CEBE, 2006). In Malaysia, the issue of environmental in architectural education is still at its infancy although the issue of energy efficiency in building has taken off as an important issue by the government. In UTM, environmental issues were recognized as one of the important aspects in students' design projects. The workbase system was introduced in 1986 at the Department of Architecture in UTM to spark interest and specialization among the lecturers and an environmental design studio was one of the workbases (UTM, 2005).

Environmental issues in architectural education are very vast and wide. They range from the very basic issues such as building climatology to the very specific such as bio architecture, sustainable architecture and energy efficient design. Apart from that, environmental issues also encompass technical and social issues such as environmental system controls, environmental behaviour and environmental psychology. In the context of this research work, basic environmental issues which include climatic elements such as sun, wind and light; energy conscious buildings and environmentally friendly building design were selected because the purpose of this survey is to gauge the level of awareness of basic environmental issues among architectural undergraduate students in UTM.

THE SURVEY

The questionnaires were distributed to the students towards the end of the semester; that is during semester II, session 2006/2007 during the Portfolio day. Questionnaires were distributed and collected on the same day. Results of the survey were grouped and presented under four subheadings as follows:-

- A – Students Background
- B – Background understanding on general environmental issues
- C – General environmental issues in design studio
- D – Basic environmental understanding in design
- E – Computers in architectural design
- F – Suggestions to improve the running of environmental workbase in architectural studio in UTM

THE RESULTS

Section A – Background of students

153 of the 309 current students comprising from Year 2 to Year 6 in Bachelor Degree in Architecture course participate in the survey, which contributes to 49.5% response rate as shown in Table 1. The 1st Year students and 5th Year students were not included in the survey. This is due to the fact that the 1st Year students did not have the privilege to choose which design unit they are interested in as their design unit is assigned to them. While the 5th year students were not around in the campus as they are currently on their practical training attachment in architect office of their choice. The results shows that the majority of students, more than 70% across the 2nd to 6th year students have the opportunity to be in the environmental design studio as shown in Table 1. Most students (27%) believe and interested that environmental issues are important in architecture and this is the main reason for them to choose environmental design studio.

Table 1 : Sample size

| Year | Total number of students in the Faculty | Number of students participate survey | Percentage of students participate in | of Joined Environmental Workbase before |
|----------------------|---|---------------------------------------|---------------------------------------|---|
| 2 nd Year | 78 | 58 | 74.4% | 29% |
| 3 rd Year | 106 | 22 | 20.7% | 91% |
| 4 th Year | 58 | 26 | 44.8% | 100% |
| 6 th Year | 67 | 47 | 70.1% | 77% |
| | 309 | 153 | 49.5% | |

Section B – Background understanding on general environmental issues

It is significantly to note that almost all students do understand and aware of the general issues in environment. All the students surveyed (100%), knew that Malaysia have tropical climate. However, when asked what are the characteristics of the Malaysia's climate, majority of the students, more than 70% mentioned only hot and humid where as they are expected to answer hot humid AND heavy rainfall throughout the year. This probably indicates that the majority of the students know in theory only that Malaysia's climate is hot and humid.

More than 80% of the students believe that climate can be a form giver to building design. However, more than 50% of the students lack knowledge on current environmental issues. For example, majority of students in 2nd year, 4th year, and 6th year (45%) seems not sure whether Government of Malaysia is serious about energy

conscious issues in buildings. Nevertheless, more than 50% of the 3rd yr students were in agreement that Government of Malaysia is serious about energy conscious issues in buildings.

In general, there is a very good level of agreement between the students from 2nd year to 6th year that Uniform Building By Law (UBBL) is one of the requirement that need to be comply with when designing and they do aware about the requirement to provide natural lighting and natural ventilation in the UBBL.

Some general knowledge question on environmental issues were asked to the students. Majority of the students awareness on general environmental issues are satisfactory, as in table 2. This shows that the students are well aware of general knowledge in environmental issue. However, contrast to the above finding, students seems not aware of current environmental issues. This is illustrates by when the students were asked about the LEO building in Putrajaya, more than 40% of the students throughout the years were not sure whether it is a good example of energy efficient building in Malaysia and the head office of MEWC.

Table 2

| | | 2nd Year | 3rd Year | 4th Year | 6th Year |
|--|------------------|----------|----------|----------|----------|
| Q13: The majority of office buildings in big cities in Malaysia are environmental friendly & energy conscious | Totally Agree | 1 2% | 0% | 2 8% | 6 14% |
| | Agree | 3 5% | 3 14% | 2 8% | 4 9% |
| | Not Sure | 14 24% | 4 18% | 4 15% | 8 19% |
| | Disagree | 34 59% | 11 50% | 16 62% | 25 58% |
| | Totally Disagree | 5 9% | 4 18% | 2 8% | 0% |
| | Do Not Answer | 1 2% | 0% | 0 0% | 0% |
| Q16 : Traditional houses In M'sia were designed with deep understanding of climatic elements such as the sun, rain & natural ventilation | Totally Agree | 25 43% | 17 77% | 19 73% | 17 40% |
| | Agree | 32 55% | 5 23% | 7 27% | 20 47% |
| | Not Sure | 0 0% | 0% | 0% | 2 5% |
| | Disagree | 1 2% | 0% | 0% | 3 7% |
| | Totally Disagree | 0 0% | 0% | 0% | 1 2% |
| | Do Not Answer | 0 0 | 0% | 0% | 0 0% |
| Q17 : The design of terrace houses in M'sia complies with the climatic condition of M'sia | Totally Agree | 1 2% | 1 5% | 1 4% | 1 2% |
| | Agree | 9 16% | 4 18% | 8 31% | 7 16% |
| | Not Sure | 8 14% | 5 23% | 0 0% | 8 19% |
| | Disagree | 32 55% | 10 45% | 16 62% | 23 53% |
| | Totally Disagree | 8 14% | 2 9% | 1 4% | 3 7% |
| | Do Not Answer | 0 0 | 0% | 0 0% | 1 2% |
| Q18 : Air cond system is the only solution to solve hot condition problem faced in houses design nowadays | Totally Agree | 7 12% | 3 14% | 2 8% | 4 9% |
| | Agree | 18 31% | 0% | 7 27% | 12 28% |
| | Not Sure | 2 3% | 0% | 1 4% | 2 5% |
| | Disagree | 25 43% | 16 73% | 12 46% | 17 40% |
| | Totally Disagree | 6 10% | 3 14% | 3 12% | 7 16% |
| | Do Not Answer | 0 | 0% | 1 4% | 1 2% |

Section C – General Environmental Issues in Design Studio

It is an important finding that majority of students throughout the year agree that environmental issues in design studio is important as in Table 3.

Table 3

| | | 2nd Year | 3rd Year | 4th Year | 6th Year |
|--|------------------|----------|----------|----------|----------|
| Q19: Basic environmental issues are important when designing regardless of what workbase you are in | Totally Agree | 23.40% | 11.50% | 13.50% | 21.49% |
| | Agree | 28.48% | 10.45% | 13.50% | 18.42% |
| | Not Sure | 2.3% | 1.5% | 0.0% | 1.2% |
| | Disagree | 5.9% | 0% | 0.0% | 3.7% |
| | Totally Disagree | 0.0% | 0% | 0.0% | 0.0% |
| | Do Not Answer | 0.0% | 0% | 0.0% | 0.0% |
| Q20 : Basic climatic problem such as rain, sun shading, glare and heat should be solve while you are designing although it was not stated in the project brief | Totally Agree | 27.47% | 9.41% | 16.62% | 14.33% |
| | Agree | 27.47% | 12.55% | 10.38% | 25.58% |
| | Not Sure | 3.5% | 0% | 0.0% | 2.5% |
| | Disagree | 1.2% | 1.5% | 0.0% | 1.2% |
| | Totally Disagree | 0.0% | 0% | 0.0% | 1.2% |
| | Do Not Answer | 0.0% | 0% | 0.0% | 0.0% |
| Q21 : Environmental in physics/ environmental science subjects helps you your design project | Totally Agree | 17.29% | 5.23% | 11.42% | 10.23% |
| | Agree | 36.62% | 15.68% | 15.58% | 31.72% |
| | Not Sure | 4.7% | 2.9% | 0.0% | 2.5% |
| | Disagree | 1.2% | 0% | 0.0% | 0.0% |
| | Totally Disagree | 0.0% | 0% | 0.0% | 0.0% |
| | Do Not Answer | 0.0% | 0% | 0.0% | 0.0% |
| Q23 : Visit to various places /buildings is important in order for the students to understand environmental issues in design. | Totally Agree | 39.67% | 12.55% | 15.58% | 25.58% |
| | Agree | 16.28% | 9.41% | 11.42% | 15.35% |
| | Not Sure | 3.5% | 1.5% | 0.0% | 3.7% |
| | Disagree | 0.0% | 0% | 0.0% | 0.0% |
| | Totally Disagree | 0.0% | 0% | 0.0% | 0.0% |
| | Do Not Answer | 0.0% | 0% | 0.0% | 0.0% |
| Q24 : Case studies of good environmental friendly building can enhance more of your knowledge and understanding about environmental issues in design | Totally Agree | 30.52% | 10.45% | 20.77% | 24.56% |
| | Agree | 25.43% | 9.41% | 6.23% | 17.40% |
| | Not Sure | 0.0% | 3.14% | 0.0% | 2.5% |
| | Disagree | 1.2% | 0% | 0.0% | 0.0% |
| | Totally Disagree | 2.3% | 0% | 0.0% | 0.0% |
| | Do Not Answer | 0.0% | 0% | 0.0% | 0.0% |

Section D – Basic environmental understanding in design

Most students agree that the location of North point is important in design. Majority of students (more than 70%) agree that to show the orientation of the site and to show the sun movement for example sun rise and sun set were the most important aspect in design.

Table 4

| | | 2nd Year | 3rd Year | 4th Year | 6th Year |
|--|------------------|----------|----------|----------|----------|
| Q25: To know the location of North point is important when you start designing | Totally Agree | 31 53% | 15 68% | 21 81% | 21 49% |
| | Agree | 26 45% | 7 32% | 5 19% | 18 42% |
| | Not Sure | 0 0% | 0% | 0 0% | 1 2% |
| | Disagree | 1 2% | 0% | 0 0% | 1 2% |
| | Totally Disagree | 0 0% | 0% | 0 0% | 0 0% |
| | Do Not Answer | 0 0% | 0% | 0 0% | 2 5% |
| Q26 : The North point must be drawn in your site plan and plan | Totally Agree | 40 69% | 19 86% | 21 81% | 25 58% |
| | Agree | 18 31% | 3 14% | 5 19% | 15 35% |
| | Not Sure | 0 0% | 0% | 0% | 1 2% |
| | Disagree | 0 0% | 0% | 0% | 0% |
| | Totally Disagree | 0 0% | 0% | 0% | 0% |
| | Do Not Answer | 0 0% | 0% | 0% | 2 5% |

It is an interesting fact that majority of the students knew what is a sun path diagram and the students believe that a sun path diagram is an important tool when designing. Apart from that the students also agree that daylight is one of the important factors when designing building in Malaysia as well as thermal comfort. The results of Q28 – Q31 was illustrated in table 5.

Table 5

| | | 2nd Year | 3rd Year | 4th Year | 6th Year |
|---|------------------|----------|----------|----------|----------|
| Q28: Do you know what is a sun path diagram? | Yes | 44 76% | 18 82% | 25 96% | 31 72% |
| | No | 2 3% | 2 9% | 0 0% | 3 7% |
| | Not Sure | 12 21% | 2 9% | 0 0% | 7 16% |
| | Do Not Answer | 58 0% | 0% | 1 4% | 2 5% |
| Q29: A sun path diagram is an important tool when designing | Totally Agree | 20 34% | 7 32% | 10 38% | 13 30% |
| | Agree | 29 50% | 9 41% | 16 62% | 18 42% |
| | Not Sure | 8 14% | 4 18% | 0 0% | 9 21% |
| | Disagree | 0 0% | 2 9% | 0 0% | 1 2% |
| | Totally Disagree | 0 0% | 0% | 0 0% | 0 0% |

| | Do Not Answer | 1 2% | 0% | 0 0% | 2 5% |
|---|------------------|--------|--------|--------|--------|
| Q30 : Daylight is one of the important factors when designing building in M'sia | Totally Agree | 32 55% | 12 55% | 13 50% | 16 37% |
| | Agree | 24 41% | 9 41% | 13 50% | 27 63% |
| | Not Sure | 0 0% | 1 5% | 0 0% | 0 0% |
| | Disagree | 1 2% | 0% | 0 0% | 0 0% |
| | Totally Disagree | 0 0% | 0% | 0 0% | 0 0% |
| | Do Not Answer | 1 2% | 0% | 0 0% | 0 0% |
| Q31 : Thermal comfort is one of the important factors when designing in M'sia. | Totally Agree | 36 62% | 14 64% | 16 62% | 19 44% |
| | Agree | 19 33% | 6 27% | 10 38% | 23 53% |
| | Not Sure | 3 5% | 2 9% | 0 0% | 1 2% |
| | Disagree | 0 0% | 0% | 0 0% | 0 0% |
| | Totally Disagree | 0 0% | 0% | 0 0% | 0 0% |
| | Do Not Answer | 0 0 | 0% | 0 0% | 0 0% |

However when the students were asked on what is the function of a window, most of the students answers to allow natural ventilation, daylight, view as well as sunlight. The appropriate answer should be to allow natural ventilation, daylight and view. This indicates that the most students do not understand the difference between daylight and sunlight in design, especially in hot and humid Malaysia.

Section E – Computers in Architectural Design

In this section students were asked about the use and the importance of computers in architectural design. Except for 2nd year students, majority of the students agree that computers and CAAD software are important tool in designing nowadays as well as to understand climatic element such as sun movement and shading requirement when designing. On the other hand, students of the upper years; Year 4 and Year 6 seems to have explore other software that can enhance the environmental issues in design. This is no doubt an acceptable answer since the lower years were not exposed to others computer software just yet. Table 6 illustrates the results for this section.

Table 6

| | | 2nd Year | 3rd Year | 4th Year | 6th Year |
|---|------------------|----------|----------|----------|----------|
| Q35 : Computers and CAAD softwares are important tool in designing nowadays | Totally Agree | 0% | 17 77% | 21 81% | 14 33% |
| | Agree | 24 41% | 4 18% | 4 15% | 25 58% |
| | Not Sure | 31 53% | 1 5% | 1 4% | 0 0% |
| | Disagree | 0 0% | 0% | 0% | 4 9% |
| | Totally Disagree | 2 3% | 0% | 0% | 0 0% |
| | Do Not Answer | 1 2% | 0% | 0% | 0 0% |
| Q36 : By using computer to | Totally Agree | 0 0% | 9 41% | 12 46% | 8 19% |

| | | | | | |
|--|------------------|--------|-------|--------|--------|
| software such as Sketch Up assist you in designing, the software also helps you to understand climatic element such as sun movement and shading requirement of a particular building that you are designing. | Agree | 20 34% | 5 23% | 10 38% | 30 70% |
| | Not Sure | 29 50% | 4 18% | 4 15% | 5 12% |
| | Disagree | 5 9% | 3 14% | 0% | 0 0% |
| | Totally Disagree | 4 7% | 1 5% | 0% | 0 0% |
| | Do Not Answer | 0 0% | 0% | 0% | 0 0% |
| Q37: Besides the existing CAAD software that you use to assist design activities, there are other software that can enhance the environmental issues in your design. | Totally Agree | 0 0% | 6 27% | 11 42% | 12 28% |
| | Agree | 12 21% | 7 32% | 11 42% | 25 58% |
| | Not Sure | 22 38% | 8 36% | 4 15% | 6 14% |
| | Disagree | 23 40% | 0% | 0% | 0 0% |
| | Totally Disagree | 1 2% | 0% | 0% | 0 0% |
| | Do Not Answer | 0 0% | 1 5% | 0% | 0 0% |

Section F – Suggestions to improve the running of environmental workbase in architectural studio in UTM

In this section, students were asked whether they have any other comments or suggestions that they think might help the successful running of environmental workbase in Architecture Department in UTM. More than 50% of students throughout the year did not answer this question. However it is worth noting that there are significant results from this question. Most students who answer this question think that there are something need to be done in order to improve the running of environmental workbase. For example, students suggested;

Teach the student how to use other software to study the environmental. The new technology to energy and environmentally has to be told to the students

Environmental software can help the students to understand how the environmental design works Environmental software can help the students to understand how the environmental design works

Site visit and trip to energy saving building such as Mesiniaga will help to understand better. The application of an environmental design of building.

More input from lectures to students on environment issues. More talks on environmental issues as now no seminar on any environmental workbase

All the environmental simulation should be taught in studio. Which software should be used and how to use it. If not there is no major difference with other workbase. The technologies are out there, but student still know nothing. All they know are basic principles and technologies.

More trips and case studies, talks by architects who know, believe in environmental design

The above statement are some of the comments from the students. Table 7 shows the overall results. It can be concluded that majority of the students who answer this question suggested that it is time to teach and to include environmental software in the studio. Apart from that, the students also believe that visits to environmentally design buildings is important in order for the students to understand environmental design issues.

Table 7

| Q41 : Any other comments or workbase suggestion that you think might help the successful running of environmental in Architectural Department UTM | 2nd Year | 3rd Year | 4th Year | 6th Year |
|---|------------|------------|------------|------------|
| CRIT | 2% | 0% | 0% | 0% |
| Do Not Answer | 62% | 59% | 50% | 67% |
| EXPLORATION | 0% | 0% | 4% | 0% |
| INPUT | 10% | 5% | 0% | 0% |
| INTEGRATED STUDIO | 0% | 0% | 0% | 2% |
| LAB | 0% | 5% | 4% | 0% |
| LECTURER | 0% | 5% | 0% | 0% |
| MANUAL | 0% | 5% | 0% | 0% |
| MATERIAL | 0% | 0% | 0% | 2% |
| MODEL | 2% | 0% | 4% | 2% |
| PASSIVE METHOD | 0% | 0% | 4% | 0% |
| PROJECT | 2% | 0% | 4% | 0% |
| SOFTWARE | 9% | 14% | 12% | 15% |
| STUDIO PROGRAM | 5% | 5% | 8% | 0% |
| VISIT | 9% | 5% | 12% | 12% |

Conclusions

This research has revealed a number of important conclusions. The most important conclusion in this research is the level of awareness of the students in environmental issues is high. One of the factors the author believe that contribute to the results is majority of the students surveyed have the opportunity to be in the environmental design studio during the duration of the course and the reasons that the students stated were they believe environmental issues are important in design. However students seems to understand the theoretical aspect of environmental issues only. This is illustrates by that majority of students did not aware that the climatic elements of Malaysia such as heavy rain and direct sunlight are needed to be address in design. On the other hand, another important findings is the students lack maturity when it

comes to the current environmental issues in Malaysia. In the author opinion, there are few factors contributing to this results such as the students are not encourage to search on their own for current information, the design program did not allow for this to happen, the students have so many tasks to do at one time or it is simply the attitude of that particular students. This suggestions is in agreement with Shaari and Jaafar (2006) which have done a survey on the level of sustainability among educators in architectural schools in Malaysia. They found out that most educators obtain their knowledge on sustainability through their personal initiatives (Shaari and Jaafar, 2006).

This is not dissimilar to what happened in schools of architecture across Australia as reported by EcoDesign (2002). They found out among other things that hinder the teaching of sustainable issues in design was that sustainable subjects had to compete with more conventional vocational subjects in the architectural education curricula (EcoDesign, 2002). Never the less, the author strongly believe this problem need to be address in architectural education in Malaysia. Another findings in this research is the use of environmental software in design has gain much popularity and the school need to integrate this element in the architectural design studio. In fact the school of architecture in the University of Wales has, in a number of years use Ecotect software in their teaching of environmental design studio (Andrew et al, 2001).

In closing, several general conclusion from this research work worth noting;

1. Students admit that environmental issues are very important in design.
2. The level of awareness among architectural students on basic environmental issues is good.
3. The level of awareness among architectural students on current environmental issues in Malaysia and worldwide is unsatisfactory and need to be look into.
4. Environmental design software is in strong demand and should be teach to students.
5. The finding of this research suggest that additional research is required into how students implement environmental issues in their design project.

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