

# Environmental Literacy Level among Architecture Students in Private Universities, Klang Valley, Malaysia

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**Abstract** - The purpose of the study is to investigate environmental literacy using “AKASA” model which is the awareness, knowledge, attitude, skills and action for 2<sup>nd</sup> year and 3<sup>rd</sup> year of architecture undergraduate students from selected private university. The study intends to investigate the literacy level of all the environmental literacy variables. The sample study comprises of 234 students from 5 selected private universities with questionnaires were used as instrument of survey. The parametric study was conducted with descriptive analysis and the results shows that the environmental awareness and environmental knowledge is at high level but environmental attitude, environmental skills and environmental action is at medium level among all the students in both years. In terms of ranking, the combine year 2 and year 3 students reveal a sequential order of awareness, knowledge, attitude, skill and action which is in congruent with “AKASA’ sequence. The overall environmental literacy is at high level among all the students in both years.

**Keywords:** *environmental literacy, architecture students, private universities*

## I. INTRODUCTION

The current education system is not helping the global challenges towards nature and the current environmental crisis is reflecting the current environmental education crisis. To address the issue, universities worldwide are integrating environmental literacy in the general education. Architecture schools in particular, as they are involved with the built environment which instructs the undergraduates to design in correspondence to the site context and community, deal with building materials and create spaces for new ways of living. However, studies on environmental literacy in the architectural courses, particularly in tertiary education in Malaysia, are still scarce. Much of this environmental literacy is being integrated into our subject modules at only surface level, resulting in mediocre outcomes for an eco-literate society and individuals who takes his understandings and knowledge of the environment into practice [1].

A depth exposure to environmental literacy as the core general education is required for all degrees. The behaviour on students is that they will apply the knowledge once graduated. It is stated though that such integrated course will create them as better change agents and produce more active and effective citizenship [2].

A research in environmental literacy in architectural courses, particularly in tertiary education in Malaysia, reflected on how the environmental studies and thinking are being taken lightly and has not gone into the deeper depths of learning framework and practice. Much of this environmental literacy is being integrated into the subject modules are low or at only surface level, resulting in mediocre outcomes for an environmental literate society and individuals who takes the knowledge and understandings of the environment into practice. To achieve this, the undergraduates and even their educators need to comprehend the definition and basic principles of environmental in order to be fully submerged into this topic and able to make a difference in the learning framework as well as the future involvement with the built environment [3].

The higher education have responsibilities in systematically introducing new cohorts of architects to the values and practices of sustainable environmental design. Although it is becoming extremely significant still the process faces a number of pedagogical and professional barriers [4]. Lembaga Arkitek Malaysia (LAM) established, Council of Accreditation and Architectural Education Malaysia (CAAEM) which regulates and recognizes all matters relating to architectural education. Its aim is to produce competences that an architecture students need to achieve and recognizes design capabilities, knowledge, and skills to fulfill an architect's responsibilities who can coordinate interdisciplinary objectives. This method provides “a synthesis of knowledge, aptitudes, and attitudes” [5]. The study intends to find the level of environmental awareness, knowledge, attitude, skills and action in year 2 and year 3 of

undergraduate architecture students in selected private university in Klang valley.

## II. METHOD

The focus of the study intends to investigate environmental literacy using AKASA model which is the environmental awareness, knowledge, attitude, skills and action from the 2<sup>nd</sup> year and 3<sup>rd</sup> year architecture undergraduate students from selected private university. In order to achieve the environmental literacy objectives, the first component is environmental awareness which is designed to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems. The second component is environmental knowledge which is to help social groups and individuals gain a variety of experiences in and acquire a basic understanding of the environment and its associated problems. The third component is environmental attitudes which is to help social groups and individuals acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection. The fourth component is environmental skills which is to help social groups and individuals acquire the skills for identifying and solving environmental problems and lastly the fifth component is environmental action which is to help provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems [6]. The selected private universities are accredited by Lembaga Akitek Malaysia (LAM) Part 1 and Malaysia Qualification Agency [7].

The construction of the research effort was aided by the methodologies provided in several existing research documents. As the focus group of undergraduate architecture students have prior education on environment therefore the questionnaire is prepared based on direct translation of various definitions of environmental literacy given in literature of environmental education. The student survey questionnaire instrument contains 85 questions in a five-point Likert-style scale where the number "5" indicate strongly agree response and "1" indicated the strongly disagree response. The questionnaire is divided into section A which question on demographic and background Information and section B is on level of environmental awareness, knowledge, attitude, skills and action towards architectural studies.

Some of the questions in the questionnaire whereby student's ability in acquiring knowledge to describe principles of energy conscious design, exemplify environmental strategies already adopted in the vernacular architectural language of Malaysia, exemplify and explain the concept of sustainability including environmental and ecological sustainability and students will be able to explain energy requirements in buildings and building materials. Student's capability in identifying the local climatic and related environmental concerns. Utilizing strategies which will encourage effective local sustainable design principles and building practices.

Student's ability in acquiring knowledge in designing buildings which responds to site context and applying appropriate design strategies for climate responsive architecture. Students also demonstrate their understanding of energy conscious design by recalling and applying understanding of specific knowledge such as services systems and low embodied energy materials to be used. Students have the ability to use various laboratory equipment's, tools and software to enhance their skills to apply the knowledge in designing sustainable building.

Student's ability in understanding the physics of building in achieving energy efficient design which respond to local climate conditions that reduces the energy load of mechanical air-conditioning systems. Thermal mechanisms such as solar radiation, heat conduction, heat resistance and heat convection are explored and how building materials respond to thermal mechanisms as well as various strategies of reducing heat gain in the interior spaces through control of building materials.

Student's capability in explaining the effects of the sun on the thermal performance of buildings, including the effect of insulation, thermal mass and air movement on thermal performance of buildings. Infer how different building material's conductivity value, transmittance value and resistivity value has different effect on heat gain or thermal environment in a given space. Students are able to estimate heat gain, overall thermal transfer value in a space and to provide passive solutions for buildings which they design.

Student's ability in integrating day lighting and artificial lighting into lighting design in a building. Able to calculate the required amounts of external opening to provide adequate internal illumination levels for simple designs. Students ability to design simple acoustically-compatible spaces that enhance sound qualities in spaces while exploring noise reduction method to achieve required reverberation time and acoustic comfort.

Student's ability in developing their own position in their individual project within the theme of sustainable architecture for people, place and time. Key aspect of the design project is to develop holistic and integrated aspects of environmental, technology and cultural context in architectural design. Student's ability in developing environmental strategies and technological resolutions with the main intent to strengthen their design exploration/ideas, and complement their design through a comprehensive environmental design.

Based on the population size of 600, for each selected university, sample size is extracted based on proportion ratio method and total recommended sample size is 234 from 5 private universities. The pilot study with 50 questionnaires was tabulated with a Cronbach Alpha of 0.955, suggesting the items have relatively excellent reliability and internal consistency. Two PhD architecture senior lecturers validated the questionnaire before it was distributed to the study population. For the main study, descriptive analysis was used to gauge percentages mean variance and standard deviation. Since the study is parametric study, inferential statistics was used such as independence t-test. The main study with 234 questionnaires was tabulated with a Cronbach Alpha of 0.952, also suggesting

that the items have relatively high reliability and excellent internal consistency.

*A. Descriptive Information of the Population Size*

Table I shows the descriptive information of the population size based on year and selected universities involved in the research study.

TABLE I. BREAKDOWN OF POPULATION SIZE BASED ON YEAR AND SELECTED UNIVERSITIES

Population Size (N)	Institution Code	Year 2	Year 3	Total
TARUC	Institution 1	19	23	42
LKW	Institution 2	24	26	50
UCSI	Institution 3	21	27	48
UTAR	Institution 4	23	26	49
TAYLORS	Institution 5	208	205	413
<b>TOTAL</b>		<b>295</b>	<b>307</b>	<b>602</b>

The population size (N) of year 2 and year 3 undergraduate architecture students in Institution 1 is 42 students, Institution 2 is 50 students, Institution 3 is 48 students, Institution 4 is 49 students and in Institution 5 is 413 students. The total undergraduate year 2 and year 3 architecture students in all the selected universities are 602.

*B. Descriptive Information of the Sample Size and Age*

For each selected university, the sample size (S) is extracted based on proportion ratio method using the formula below.

$$\frac{\text{Total Architecture students in one University}}{\text{Total Population Size of All Universities}} \times \text{Total Sample Size}$$

Table II shows the descriptive information of the number of sample size based on universities and average mean age which is well distributed among the universities. Year 2 and year 3 undergraduate architecture students age ranges from 20 to 23 years old. The mean age of student's sample size is 21.12.

TABLE II. DESCRIPTIVE INFORMATION OF SAMPLE SIZE AND MEAN AGE DISTRIBUTION

University	Sample Size (S) and Age		
	N	%	Mean
Institution 1	16	6.84%	21.69
Institution 2	19	8.12%	20.68
Institution 3	19	8.12%	21.05
Institution 4	19	8.12%	21.63
Institution 5	161	68.80%	21.07
<b>TOTAL</b>	<b>234</b>	<b>100.00%</b>	<b>21.12</b>

*C. Descriptive Information of the Year of Study and Gender*

Table III shows the descriptive information of the sample involved in the research study. The table indicates breakdown

number and percentages of year of study which is year 2 and year 3 and number of male and female gender with percentage distribution based on selected universities.

TABLE III. DESCRIPTIVE INFORMATION OF THE YEAR OF STUDY AND GENDER DISTRIBUTION

Institution	Year Study				Gender			
	Year 2		Year 3		Male		Female	
	N	%	N	%	N	%	N	%
Inst. 1	7	6.14	9	7.50	10	8.06	6	5.45
Inst. 2	9	7.89	10	8.33	9	7.26	10	9.09
Inst. 3	8	7.02	11	9.17	9	7.26	10	9.09
Inst. 4	9	7.89	10	8.33	13	10.48	6	5.45
Inst. 5	81	71.05	80	66.67	83	66.94	78	70.91
<b>TOTAL</b>	<b>114</b>	<b>100</b>	<b>120</b>	<b>100</b>	<b>124</b>	<b>100</b>	<b>110</b>	<b>100</b>

The total sample size for year 2 is 114 (48.72%) and total sample size of year 3 is 120 (51.28%). The total male sample size is 124 (53.00%) and the female sample size is 110 (47.00%). The selected universities have equal sample size number of year 2 and year 3 undergraduate architecture students and equal well distributed male and female undergraduate architecture students.

III. RESULTS

*A. Descriptive Analysis using Mean Score and Standard Deviation for Environmental Literacy Variables in Year 2 and Year 3*

To analyse the level of environmental awareness, knowledge, attitude, skills and action in year 2 and year 3 of undergraduate architecture students in private universities, the mean score and standard deviations for year 2 and year 3 are measured separately. The level can be determined by using mean score and the significance means difference can be measured using independent t-test. Table IV discusses the interpretations of mean scores to determine the environmental literacy variables level and overall environmental literacy level for year 2 in selected private university.

TABLE IV. MEAN SCORE INTERPRETATION

Mean Score	Level
1.00 to 2.33	Low
2.34 to 3.66	Medium
3.67 to 5.00	High

<sup>8</sup>Polit & Hunglers, (1999)

*B. Comparison of Level in Environmental Literacy Variables for Year 2*

Table V shows the mean score and ranking of variables for environmental literacy level for respondents in year 2 from the

selected private universities. The results show that the environmental awareness is high level with the highest mean score ( $M=4.39$ ,  $SD=.410$ ). This is followed by environmental knowledge level is also high with mean score ( $M=4.19$ ,  $SD=.428$ ). The third in rank is environmental attitude which is in medium level with mean score ( $M=3.56$ ,  $SD=.390$ ). Followed by environmental action is in medium level with mean score ( $M=3.49$ ,  $SD=.489$ ) and the last fifth in rank is environmental skill which is in medium level with mean score ( $M=3.41$ ,  $SD=.580$ ). The overall environmental literacy for year 2 shows a high level above 3.67 with a mean score of ( $M=3.81$ ,  $SD=.312$ ).

TABLE V. MEAN AND SD IN ENVIRONMENTAL LITERACY VARIABLES FOR YEAR 2

Environmental Literacy Variables	Year 2		
	n	Mean	SD
E Awareness	114	4.39	.410
E Knowledge	114	4.19	.428
E Attitude	114	3.56	.390
E Skill	114	3.41	.580
E Action	114	3.49	.489
E Literacy	114	3.81	.312

### C. Comparison of Level in Environmental Literacy Variables for Year 3

Table VI shows the mean score and ranking of variables for environmental literacy level for respondents in year 3 from the selected private universities. The results show that the environmental awareness is high level with the highest mean score ( $M=4.24$ ,  $SD=.604$ ). This is followed by environmental knowledge level is also high with mean score ( $M=4.09$ ,  $SD=.569$ ). The third in rank is environmental skill which is in medium level with mean score ( $M=3.56$ ,  $SD=.677$ ). Followed by environmental attitude is in medium level with mean score ( $M=3.51$ ,  $SD=.476$ ) and the last fifth in rank is environmental action which is in medium level with mean score ( $M=3.39$ ,  $SD=.527$ ). The overall environmental literacy for year 3 shows a high level above 3.67 with a mean score of ( $M=3.76$ ,  $SD=.446$ ).

TABLE VI. MEAN AND SD IN ENVIRONMENTAL LITERACY VARIABLES FOR YEAR 3

Environmental Literacy Variables	Year 3		
	n	Mean	SD
E Awareness	120	4.24	.604
E Knowledge	120	4.09	.569
E Attitude	120	3.51	.476
E Skill	120	3.56	.677
E Action	120	3.39	.527
E Literacy	120	3.76	.446

### D. Comparison of Level in Environmental Literacy Variables for Year 2 and Year 3 Combine

Table VII shows the mean score and ranking of variables for environmental literacy level for respondents in year 2 and year 3 combine from the selected private universities.

TABLE VII. MEAN AND SD IN ENVIRONMENTAL LITERACY VARIABLES FOR YEAR 2 AND YEAR 3 COMBINE STUDENTS

Environmental Literacy Variables	Year 2 and Year 3 Combine		
	n	Mean	SD
E Awareness	234	4.31	.531
E Knowledge	234	4.14	.506
E Attitude	234	3.54	.436
E Skill	234	3.49	.634
E Action	234	3.44	.509
E Literacy	234	3.78	.386

The results show that the environmental awareness is high level with the highest mean score ( $M=4.31$ ,  $SD=.531$ ). This is followed by environmental knowledge level is also high with mean score ( $M=4.14$ ,  $SD=.506$ ). The third in rank is environmental attitude which is in medium level with mean score ( $M=3.54$ ,  $SD=.436$ ). Followed by environmental skill is in medium level with mean score ( $M=3.49$ ,  $SD=.634$ ) and the last fifth in rank is environmental action which is in medium level with mean score ( $M=3.44$ ,  $SD=.509$ ). The overall environmental literacy for year 2 and year 3 combine shows a high level above 3.67 with a mean score of ( $M=3.78$ ,  $SD=.386$ ).

Based on independent sample t-test in Table VIII, the only significant mean differences for variables of environmental literacy between year 2 and year 3 from selected private universities is environmental awareness (EAW),  $t(232) = 2.285$ ,  $p=0.023$ . These results suggest that the more years in the university and more number of environmental related modules students have taken in year 3 have significant influence on the environmental awareness of the students.

TABLE VIII. INDEPENDENT t-test IN ENVIRONMENTAL LITERACY VARIABLES FOR YEAR 2 AND YEAR 3 STUDENTS.

Environmental Literacy Variables	Year 2 and Year 3 Combine		
	n	t	p
E Awareness	234	2.285	0.023*
E Knowledge	234	1.353	0.177
E Attitude	234	0.835	0.405
E Skill	234	-1.753	0.081
E Action	234	1.512	0.132
E Literacy	234	0.988	0.324

\*The mean difference is significance at the  $p \leq 0.05$  level

## IV. DISCUSSION

The study reveals a high level of literacy in environmental awareness and environmental knowledge variables in year 2, year 3 and combination of year 2 and 3 students. The results indicate that the student's sensitivity to the total environment and its problems are at high level. Furthermore, the information on the environment gained from a variety of involvements to a basic understanding of its related problems is also at high level.

Student's awareness and knowledge is demonstrated by reorganizing environmental issues as well as grasping the roots, implications and consequences of those problems. Student's learning outcome in the environmental subjects which are designed in the current context for undergraduate architecture students are more relevance towards environmental awareness and environmental knowledge which is in line with Blooms Taxonomy educational objectives.

This study is in congruent with [9] with the findings that the upper secondary students have high environmental awareness and have higher level of involvement in environmental activities. Student's environmental knowledge is influenced by their immediate involvements and by the content of books [10]. Low level of environmental knowledge is perceived among high school students in national survey in United States [11].

However, the results also suggest that medium level of literacy in environmental attitude, environmental skill and environmental action in year 2, year 3 and combinations of both years shows that student's literacy in environmental attitude, environmental skill and environmental action have less depth. The study reveals that the student's ethics and feelings of concern for the environment and enthusiasm for actively partaking in environmental improvement and protection are at medium level. Furthermore, students acquired skills for identifying and solving environmental problems are at medium level. Students also find the prospect to be actively involved at all levels in working towards a resolution of environmental problems is at a medium level.

This study is supportive with [12] which reported that young people's environmental attitudes varied but supportive on environmental conservation in Turkey. The undergraduate students from Pamukkale University in School of Foreign Languages, Turkey had positive attitudes toward the environment [13].

Due to high level of literacy in environmental awareness and knowledge but medium level of environmental attitude, skills and actions, there is an imbalance due to increased modularization of environmental modules making the connections between them weaker. The fragmented teaching objectives and delivery of content in smaller entities and disconnected making architecture students difficult to make the connections [14]. Subjects involved in the teaching of building physics or building sciences are taught as a separate entity had little to do with the design process [15]. Interaction between various modules components especially environmental module is imperative as integration is important to design sustainable buildings [16].

On the contrary, the results also suggest that high level of overall environmental literacy in year 2, year 3 and combination of year 2 and year 3 students. This supports the Malaysian architectural education accreditation body which sets "a satisfactory balance between theory and practice" as its first qualitative standards, in terms of the anticipated scope of competencies that an architecture student needs to attain and identifies design capabilities, knowledge, and skills to accomplish an architect's role as generalists who can co-ordinate interdisciplinary objectives. The council also endorses

teaching based on project realization as the principle teaching method. This approach places students under the direct and personal guidance of lecturers. This method provides "a synthesis of knowledge, aptitudes, and attitudes" [5].

In terms of literacy ranking for year 2, the sequence is environmental awareness, knowledge, attitude, action and skill. However, literacy ranking for year 3, the sequence is awareness, knowledge, skill, attitude and action. The most interesting finding was that literacy ranking for combination of year 2 and year 3 students reveals a sequence of awareness, knowledge, attitude, skill and action which is in congruent with "AKASA" sequence and considered to be from the simplest to the more complex, interdependent, and must be achieved one step at a time [17].

This study supports research in [18], which shows individuals' environmental awareness is molded by their knowledge, attitude and interrelationships among its components. Positive attitudes and knowledge lead to positive environmental behaviors, mediated by behavioral intentions and environmental effects. There is a link between students' environmental opinions and their preparedness to act to save the environment.

Independent sample t-test reveals there are significant mean differences for environmental awareness between year 2 and year 3. The result reveals that the number of years and the amount of architecture and environmental subjects the students exposed at higher years are an influencing factor in the student's literacy in environmental awareness. This study supports research which indicates students towards the completion of their studies described increased participation in most of the study's environmental behavior categories as compared to the beginning [19]. It will be a good attempt if students are also exposed to more environmental subjects at the beginning of the year eg. foundation year or year 1. This attempt will not only enhance more environmental awareness and knowledge, but perhaps will able to see significant increase in mean ranking in the environmental skill, attitude and action.

## V. CONCLUSIONS

This study concludes that the environmental awareness and environmental knowledge is at high level but environmental attitude, environmental skills and environmental action is at medium level among year 2, year 3 and combination of year 2 and year 3 architecture undergraduate students. However, the overall environmental literacy is at high level among year 2, year 3 and combination of year 2 and year 3 architecture undergraduate students. Environmental literacy ranking for year 2 and year 3 are slightly different but for the combination of year 2 and year 3 students reveals a sequence of awareness, knowledge, attitude, skill and action which is in congruent with "AKASA" sequence.

In conclusion, the environmental literacy does not have any significant mean difference between the year of study and the selected private universities. This indicates that, Lembaga Arkitek Malaysia (LAM) established, Council of Accreditation and Architectural Education Malaysia (CAAEM) which

regulates and recognizes all matters relating to architectural education has its own set of criteria for architecture education and graduates for schools to meet.

This study has limitations of absence of research studies related to programme specific technical subject like architecture in environmental literacy and sustainability studies. Most literature is sought from overseas reference where social, educational and cultural background is different in comparison to Malaysia context. This study is also inclined to depend on the architecture programme core curriculum framework with its own objectives to ensure content rationality which will be very difficult to compare with other program-specific studies such as business, engineering or art. Variety of assessment frameworks and tools make it challenging to compare and integrate study results across programs.

The implications of this study will establish the level, the ranking and the significant correlation of environmental awareness, knowledge, attitude, skills, action and environmental literacy of year 2 and year 3 of undergraduate architecture students in Malaysian private university. The findings will assist the policy-makers, educators, planners and implementers in gauging the effectiveness of our current environmental related syllabus and education system. Effective strategies can be sorted for effective dissemination of information through the university accreditation bodies. This study also will determine the factors which need to be emphasized especially in depth information on environmental action among undergraduate architecture students in private universities.

This study can be further explored to measure gender comparison on architectural environmental literacy between male and female, how students background from science and arts stream, which influences environmental literacy, environmental literacy level in comparison between students from urban compared to rural students. The research also can be extended to comparison in ethnicity, local architecture students compared to international students and the influence in environmental literacy level. Research can be extended on comparison between environmental literacy among different faculties such as business school, computer school, engineering school and architecture school. In view of administrators of higher institutions central role in policy making in relation to environmental education, further environmental literacy issues such as availability of resources, revamping of curriculum and policy change can be explored.

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