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Sustainability knowledge using “AKASA” model among architecture students from Klang Valley private universities, Malaysia.

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Abstract. The study intend to investigate sustainability knowledge using “AKASA” model. This model comprises all the literacy level which is the awareness, knowledge, attitude, skills and action. 234 students from 5 selected private universities were surveyed using questionnaires. Students were specifically selected from year 2 and year 3 from private universities in Klang valley, Malaysia. The study intends to investigate the environmental literacy level specifically the knowledge variable. The parametric study was conducted with descriptive analysis and the results shows that the environmental knowledge is at high level compared to other environmental literacy variables among year 2, year 3 and combine year 2 and year 3.

1. 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 particularly in architecture schools, 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 [1].

However, studies on environmental literacy in tertiary education in Malaysian architectural courses, 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. Research in environmental literacy in architectural courses, 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 [2]. Lembaga Arkitek Malaysia (LAM) established, Council of Accreditation and Architectural Education Malaysia (CAAEM) which regulates and recognizes all matters relating to architectural education has aimed 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 co-ordinate interdisciplinary objectives. This method provides “a synthesis of knowledge, aptitudes, and attitudes” [3]. The study intends to find the level of environmental knowledge in year 2 and year 3 of undergraduate architecture students in selected private university in Klang valley.

1.1 Research in Environmental Knowledge

As mentioned in [4], demographic differences such as gender and ethnicity influenced environmental knowledge in a survey in Kentucky, United States. The study revealed that comparatively respondents from urban-metro were more knowledgeable about global issues compared to urban-non-metro and rural-non-metro respondents. The study in [5] also supported on the influence of environmental knowledge and concluded that gender and ethnicity is significance whereby blacks and women are generally less knowledgeable in terms of environmental issues compared to whites and men. As reported in [6], low level of environmental knowledge from 10th to 12th grade among high school students in national survey in United States. Environmental knowledge of children is influenced by their immediate experiences and by the content of books they use in a study of elementary school students in Greece [7].

As mentioned in [8], a significant difference in environmental knowledge levels among the three groups of science education, biology and chemistry major students in Western University, United States. A high level of environmental knowledge among their students at Michigan State University compared to the general public [9]. The research in environmental knowledge indicates significance towards



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ethnicity and gender. Urban-metro white men respondents are more knowledgeable comparatively. Environmental knowledge is also influenced by student's immediate experiences and by the content of books they use in a study of elementary school students. Environmental knowledge levels also differ among groups of science education and it is higher among educated students compared to general public.

2. Method

The 5 selected private universities with a population size of 600 architecture students from year 2 and year 3 are accredited by Lembaga Akitek Malaysia (LAM) Part 1 and Malaysia Qualification Agency [10]. Using proportion ratio method, the sample size were 234 architecture students from year 2 and year 3 from the selected 5 private universities. The pilot study with 50 questionnaires was tabulated with a Cronbach Alpha of 0.954, 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 student survey questionnaire is divided into Section A which on demographic and background information and Section B is on level of environmental knowledge towards architectural studies. It contains 25 questions in a five-point Likert-style scale where the number "5" indicate strongly agree response and "1" indicated the strongly disagree response. The questions on Environmental Knowledge (EKn) were mapped with subjects which are related to architectural environment such as building science, green design, sustainable energy, thermal comfort, visual comfort, acoustic comfort, recycle of building materials, air pollution and water pollution. The mapping of questions is relevant to the expected knowledge in their course of study whereby students were assessed based on capability to understand and assess the impact to society on the environment. The Cronbach alpha coefficient for environmental knowledge is 0.935, suggesting that the items have relatively excellent reliability and internal consistency.

2.1 Research Design

The existing curriculum in architecture is already intensive with large credits offered in major subjects [11]. Environmental education in architecture is to increase the sustainability of the building without compromising the site and human comfort. The goal of achieving sustainability in building can be achieved with three levels of environmental education in architectural educational objectives [12]. The first level is creating environmental awareness, the second level understanding building ecosystem and the third level is the ability to design sustainable buildings as per Figure-1. The development of research questions are based on the above mentioned educational objectives which are currently pursued in architecture environmental education curriculum.

At first level, achieving sustainability in building is by instilling environmental knowledge through modules which are related to environmental science or environmental sustainable design. Students acquire knowledge to describe principles of energy conscious design, exemplify environmental strategies already adopted in the vernacular architectural language of Malaysia. Students would be able to 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. *Environmental Knowledge (EKn)* is information on the environment gained from a variation of experiences leading to a basic understanding of its related problems. As mentioned in [6], defined it as student's capability to understand and assess the impact of society on the ecosystem. This knowledge is established by reorganizing environmental problems as well as understanding the origins, implications and consequences of those problems. To support social groups and individuals gain a diversity of experiences in and gain a basic understanding of the environment and its associated problems according to Tbilisi Declaration [13].

Environmental Literacy	Environmental Knowledge		
Environmental Education in Architecture	capability of basic understanding	assess impact & consequences	Modules
Creating Environmental Awareness	•	•	Environmental Science
Understanding Building Ecosystems	•	•	Building Material
	•	•	Building Services
	•	•	Building Science
Ability to Design Sustainable Buildings	•	•	Environmental Design Integration

Figure 1. Environmental Knowledge Questionnaire Matrix

The second level in understanding building ecosystems is achieved by incorporating sustainability into core modules such as Building Science, Building Materials and Building Services. 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. Students would acquire knowledge of designing building which responds to site context and applying appropriate design strategies for climate responsive architecture. Students also would demonstrate 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. At this level, students also have the ability of using various laboratory equipment, tools and software to enhance their skills in applying their knowledge in designing sustainable buildings. Students would have knowledge on able 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.

At third level, ability to design sustainable buildings, the emphasis on design is as an integrative process. Students are required to develop environmental strategies and technological resolutions with the main intent to strengthen their design exploration/ideas, and complement their design through a comprehensive sustainable environmental design. There are 6 accepted principles that constitutes sustainable which are: i) optimize site potential, ii) optimize energy use, iii) protect and conserve water, iv) use environmentally sustainable products, v) enhance indoor environmental quality and vi) optimize operational and maintenance practices [14]. In line with this, Malaysian Green Building Index which conforms to MS1525:2007 also emphasizes the above principles.

It is imperative for student's design to be conforming to building performance for instance thermal comfort, lighting, acoustic, conservation of water, appropriate building services systems, building material such as green materials, sustainable technology and construction methods while adhering in principle to regulatory uniform building by-laws (UBBL) and BOMBA fire regulations in order to achieve LAM recognition of Part 1. To prevent these shortcomings in Malaysia, it is critical for the studio work to put emphasis on integration of sustainable objectives together with other learning outcomes.

3. Results

3.1 Descriptive Information of the Population Size, Sample Size, Year of Study, Gender and Age

The population size (N) of year 2 and year 3 undergraduate architecture students in Institution 1 is 42 students. The population size of year 2 and year 3 students in Institution 2 is 50 students. The population size of year 2 and year 3 undergraduate architecture students in Institution 3 is 48 students. The population size of year 2 and year 3 students in Institution 4 is 49 students. The population size of year 2 and year 3 undergraduate architecture students in Institution 5 is 413 students. The total undergraduate year 2 and year 3 architecture students in all the selected universities are 602. For each selected university, the sample size (S) is extracted based on proportion ratio method using the formula below.

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

The number of sample size is based on universities and average mean age is well distributed among the universities. The total sample size for year 2 is 114 (48.72%) and total sample size of year 3 is 120 (51.28%). 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. 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.

3.2 Descriptive Analysis using Mean Score for Environmental Knowledge Variables in Year 2, Year 3 and Combine Year 2 & Year 3

To analyse the level of environmental knowledge 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 Table 1 discusses the interpretations of mean scores to determine the environmental knowledge variables level for year 2, year 3 and combine year 2 & year 3 in selected private university.

Table-1. Mean Score Interpretation [15]

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

The results show that the environmental knowledge level is high with mean score ($M=4.19, SD=.428$) for year 2 architecture students in selected private universities in Klang valley. For year 3 students, environmental knowledge level is also high with mean score ($M=4.09, SD=.569$). For combine year 2 and year 3, environmental knowledge level is also high with mean score ($M=4.14, SD=.506$). Based on independent sample t-test, there are no significant mean differences for variables of environmental knowledge between year 2 and year 3 from selected private universities Environmental Knowledge (EKn), $t (220) =1.353, p=0.177$. These results suggest that environmental knowledge variables do not have influencing factor in years of study namely for Year 2 and Year 3 from selected private universities.

4. Discussion

The study reveals a high level of literacy in environmental knowledge in year 2, year 3 and combination of year 2 and 3 students. The results indicate that the student's 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 environmental 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 knowledge which is in line with Blooms Taxonomy educational objectives. This study is in congruent with [7], observed that student's environmental knowledge is influenced by their immediate involvements and by the content of books they use in Greece. Surprisingly, earlier findings [6] reported low level of environmental knowledge among high school students in national survey in United States.

5. Conclusions

The results suggest that high level of environmental knowledge 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" [3]

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