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Letter to the editor

Review on integrating sustainability knowledge into architectural education: Practice in the UK and the USA

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A B S T R A C T

The United Nations Decade of Education for Sustainable Development steered by The United Nations Organization for Education, Science and Culture (UNESCO) since 2005 ended in 2014. It looked into the integration principles, values and practices of sustainable development in all aspects of education and learning, with the intention of addressing the global social, economic, cultural and environmental issues in the 21st century. It has become an essential issue in architectural education to create awareness among future generations of architects to be more sensitive towards the environmental impact of architecture on human behavior. This encouraged every school of architecture to incorporate sustainability knowledge into its curriculum and promote 'sustainable architectural education', leading to the questions of: what type of structural model of integration approach being applied in promoting architectural sustainable education? The objectives of this paper are to investigate the type of structural models that have been applied in architectural curriculum in selected schools of architecture in both countries and evaluate the level of emphasis in incorporating sustainability knowledge in the curriculum. Therefore, this paper reviewed the approach of integration principles, values and practices of sustainable development at 10 conveniently sampled architecture schools in the United Kingdom (UK) and the United States of America (USA). Data was collected from their respective web sites and their concepts of integration were reviewed and the distribution of credit hours revealed to determine the level of emphasis considered. Findings showed various paths taken by the different institutions in integrating the knowledge of sustainability into their architectural curriculum. This paper concludes with recommendations for further research into gauging the effectiveness of architectural curricula with integrated sustainability knowledge.

1. Introduction

Architecture is considered an important profession which shapes the built environment and plays a major role in providing basic human needs (Antonara et al., 2013; Uzunoglu and Uzunoglu, 2011). Architectural practitioners and educators have a heavy task of creating awareness among architectural students in issues of sustainability which include global warming, resource depletion and climate crisis (Altomonte, 2009; Hattan et al., 2010; Karatepe et al., 2012). The term 'sustainability' has comprehensive dimensions comprising society, economy and environment. The ability to make development sustainable is within the reach of humankind, ensuring the capacity to deliver current needs while also taking into account the rights of future generations in meeting their own needs (WCED, 1987). 40% of the total global annual energy consumption is by buildings (Taleghani et al., 2011).

Sustainability knowledge in other fields such as engineering and science allowed scientists to deal with real-life environmental issues such as predicting the pattern of algal blooms (Muttil and Kwok-Wing, 2007), prediction of daily rainfall (Chau and Wu, 2010), assessing river water quality (Wen-chuan, Dong-mei, Kwok-wing, & Guan-jun, 2014), making improvements to the environmental impact assessment technique (Ming-Yan et al., 2006). Similarly, having sustainability knowledge will make sure that future architects are able to address widespread environmental issue such as rising ambient temperatures, heavy monsoonal rains and the ensuing landslides, trans-border haze so on and so forth.

Consideration of sustainability issues in architecture has led architects to design and create buildings which are responsive to the environment such as examined by (Hyde, 2000), (Hyde et al., 2007), (Hyde, 2008), (Roaf et al., 2003), (Vale and Vale, 1991) (Mendler and Odell, 2000), and (Sassi, 2006) besides creating buildings which contribute positively to the surrounding environment as investigated by (Yeang, 2006) and (Birkeland, 2007). Realization of the importance of sustainability also led other architects to create building assessment techniques and models such as by (Cole, 1997; Cole, 2001; Cole, 2005) and (Chau, Burnett and Lee, 1999) among many others. The direct relationship of architecture to nature was theorized by (Hagan, 2001) and (Hawkes, 1996) and to sustainability by (Dresner, 2002). Therefore, inculcating the

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understanding and importance of sustainability in architectural education is paramount at training future architects who are sensitive to the issues of the environment while making sure that the built environment is comfortable and adequate for social needs.

Future architects and professional architects alike are required to be more equipped with advanced technical skills in their implementation of environmental strategies in building design to be able to upgrade environmental quality and quality of life (Altomonte, 2009). Environmental issues such as choices of materials, reduction of carbon and greenhouse gasses emissions, energy consumption, climatic design, passive and hybrid strategies, life cycle and cost effectiveness, resource efficiency including management of resources by promoting alternative or renewable energy are just a few considerations in the practice of architecture. All these could be achieved through initiating a change in the process of producing building practitioners (Altomonte, 2012a; Hattan et al., 2010).

For the last 20 years, architectural education aimed at preparing qualified graduates for the profession. Sustainable architectural education has now been incorporated into the architectural curriculum to pool new graduate architects as educated ecological architects who are able to preserve natural resources and prevent environmental decay (Hattan et al., 2010). Globally, it was noticeable how the building industry preferred hiring architects who graduated from recognized programs that ensured proficiency and commitment towards sustainable practice. These programs assimilated new techniques in delivering knowledge of sustainability, such as video cast techniques and multimedia materials (Torres-Ramírez et al., 2014).

After the oil embargo of the 1970's along with rising sustainable awareness, efforts were directed on promoting sustainable development through education. In 1987, the World Commission on Environment and Development (WCED) underlined the role of education in promoting sustainability in a society. In line with this, the International Union for Conservation of Nature (IUCN) in 1991 outlined the importance of education programs in changing attitudes towards more sustainability. This was echoed in the 1992 Earth Summit in Rio and later in the President's Council on Sustainable Development when Agenda 21 was presented, whereby the role of education in setting out the challenge for educators and hence developing sustainability was demarcated more specifically. It was the first global document that pointed out education as an essential tool for attaining sustainable development (Taleghani et al., 2011). However, the development of sustainable architectural education was impeded by various obstacles such as the ambiguous definitions and confusion over the meaning of sustainable architecture with their implementation in the curriculum as well as the lack of the experts in the educational field (Gencosmanoglua and Nezor, 2010; Taleghani et al., 2011).

Sustainable architectural education is vital in order to inculcate environmental awareness, attitudes and values of issues as well as in promoting sustainable concepts (Altomonte, 2009; Karatepe et al., 2012). It equips students with ecological, economic and technical knowledge required in architectural practice. At the same time, it also equips students with the ability to affect social changes (Guy and Moore, 2007) and able to create social propositions for architecture to interact with lifestyle and urban design (Borden, 2009). Sustainable architectural education provides basic training for professional architects and researchers to develop building technology systems as well as give assistance and advice on the advancement of the industry. It develops skills consistent with sustainable development, effectively bringing in public participation in decision-making (Altomonte, 2009).

The White Paper on Environmental Design in University Curricula and Architectural Training in Europe (EDUCATE), an Agenda for a United Euro, which discussed Sustainable Architecture Education, was presented in 2012 by the conglomeration of the University of Nottingham, the Architectural Association School of Architecture, Architecture et Climat Universite Catholique de Louvain, Technische Universitat Munchen, Dipartmento DATA Universita di Roma La Sapienza, Seminario de Arquitecture y Mediombiente, Budapesti Muszaki es Gazdasagtudomanyi Egyetem and supported by the Intelligent Energy Europe 2008 Program. It revealed a difficulty in spurring the students of architecture to embrace knowledge of sustainability in their practice and design studio projects (Altomonte, 2012b). This might refer to the transmissivity educational models and curriculum in architecture schools.

The Royal Institute of British Architects (RIBA) Appointments Skills Survey Report (2014) based on a survey involving 149 employers and 580 architectural students in the UK reviewed the real nature of the skills required and the job market. It revealed different expectations between the profession and students regarding sustainability knowledge in architecture as illustrated in Fig. 1.

The report showed the expectations of employers on students' knowledge in sustainability were higher than the students' own expectations. Part 1 students', i.e. students at the first degree level who meet the United Kingdom's (UK) Architects Registration Board's (ARB) General Criteria for Part 1 (ARB, 2010c), expectation of their own knowledge in sustainability was at 27% decreasing to 23% in Part II students and to 14% in Part III. According to the ARB (ARB, 2010a, 2010c) Part II students i.e. students at postgraduate level would also meet the General Criteria for Part I and II besides having achieved the Graduate Attribute 1, while Part III students would have achieved all 11 General Criteria for Parts I and II including both Graduate Attributes (ARB, 2010b). In addition to findings concerning the students, the expectation of the employers on students' knowledge in sustainability was at 32% in Part I, 24% in Part II and 22% in Part III (RIBA, 2014).

Feedback from the 2012 study of accredited architectural education by the National Architecture Accreditation Board (NAAB) of the United States of America (USA) on respondents including students, academicians and practitioners perception revealed that only 22% of the respondents agreed that applying principles of sustainable design was very important in architecture, while only 14% stood up for more sustainability training (Norbut et al., 2012). These two issues have provoked the following research questions; firstly what structural models of integration approach being applied in promoting architectural sustainable education. Secondly, how much emphasis has been considered in the attempt at incorporating sustainability knowledge into architectural curriculum, and what has limited the development skill of the architecture graduates in relation to sustainable development. Therefore, this paper aims to review the integration model of sustainability related knowledge in architecture curriculum in schools of architecture in developed countries such as the UK and the USA.

The objectives of the paper are firstly, to investigate the structural models of sustainable development which has been integrated, values and practices in each selected schools in the UK and USA. Secondly, to evaluate the level of emphasis in incorporating sustainability knowledge into architectural curriculum by reviewing each integration concepts and measuring the implementations. The evidence were gathered from web sites of architecture school of QS World high and low ranking universities in UK and USA which were recognized and given accreditation by their respective local board of architects.

2. Architectural profession in the UK and USA

Generally, to be accepted into the architectural profession in the