

## IMPACT OF ARCHITECTURAL EDUCATION ON ENERGY SUSTAINABILITY IN SELECTED SCHOOLS OF ARCHITECTURE IN LAGOS MEGACITY

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### Abstract

*The gap between learning and the practical aspect of energy sustainability is getting narrower when viewed in the overall content of the sustainable development goals (SDG's) agenda; therefore, this study is needed at this time. This study aims to investigate the impact of architectural education on energy sustainability in selected architectural schools in the Lagos Megacity. It explores the impact of architectural education in these schools of Architecture and how it has influenced the design and construction of energy-efficient buildings and, in turn, contributed to energy sustainability. This study adopted quantitative approach in data collection. An online survey was conducted among students and faculty members of selected architectural schools in the Lagos Megacity. The data was analyzed using statistical package for social sciences (SPSS). Findings on influences of architectural education in building design and construction with respect to energy sustainability revealed that 7.4% disagreed that architectural education had influence on building design and construction while 92.6% agreed that architectural education had influence on building design and construction. Also, impact of institutional policies showed that government policy had a significance impact of .292 (29.2%) with Nigerian Institute of Architects while Architects Registration council had a significant influence of .609 (60.9%). The study concluded that architectural education had influence on building design and construction in the school of architecture especially in Lagos Mega City. Also, that government policies had a far reaching influence on both institutional bodies that regulates architectural education in Lagos megacity.*

**KEYWORDS:** Architectural education, energy sustainability, Lagos megacity

### 1.0 Introduction

Energy Sustainability is a crucial aspect of SDG's Agenda and therefore that of sustainable development in any megacity including Lagos. Moreover, architecture plays a significant role in promoting energy efficiency and sustainability. Therefore, architectural education has a critical role to play in enhancing energy sustainability in Lagos megacity.

The aim of this study is to evaluate the extent to which architectural education has influenced the attitudes, knowledge and practices of architects at any of its stage towards energy sustainability which will contribute to the understanding of the impact of

architectural education on energy sustainability of the 21<sup>st</sup> Century in the midst of numerous challenges including climate change and shortage of natural resources. While the research objectives include: identify the respondents' demographic characteristics in the selected architecture schools and evaluate influences of architectural education in building design and construction with respect to energy sustainability among the selected schools of architecture within Lagos megacity; and evaluation of the extent to which architectural education has influence the attitudes, knowledge and practices of architect towards energy sustainability in the selected schools of architectures within Lagos megacity.

The statement of research problem can be outline as follows: the energy consumption of buildings is a significant contributor to global energy consumption and greenhouse gas emission; and architecture plays a critical role in promoting energy sustainability in buildings. However the impact of architectural education on energy sustainability is not well understood, particularly in megacity including Lagos. It is this background that necessities this study. The study significant lies in its contribution to the understanding of the impact of architectural education on energy sustainability in megacity. The geographical scope of the study will be schools of architecture within and around Lagos megacity with target audience as students. The limitations of the study are numerous among which are: the operational flexibility of curriculum in these selected schools of architecture to accommodate the evolution trend in energy sustainability in buildings; the practical exposure of student in these selected schools of architecture to the current 21<sup>st</sup> century reality and so on.

## **2.0 Literature Review**

### **2.1 Preambles**

The theoretical framework of this study investigates the relationship between architectural education and energy sustainability in Lagos Megacity based on relevant theories and concepts. If social learning theory discuss how architectural education fosters social learning for sustainability; then systems theory explores the interconnectedness of architectural education and energy sustainability; and pedagogy/curriculum framework, then analyze the curriculums influence on sustainable architectural practices.

The possible conceptual frameworks that this study could be built upon includes- triple bottom line framework (it assesses the impact of architectural education on energy sustainability by considering its influence on economic, social and environmental aspects; it also evaluates how architectural education affects the economic viability of sustainable design, its social acceptance, and its environmental impact); sustainability pedagogy framework (it centers on pedagogical approaches within architectural education which examines how sustainability is incorporated into the curriculum and how teaching methods influence students perceptions and how this impacts real-world practices); and Innovation- Diffusion theory (its assesses how innovations in architectural education such as new curricula, teaching methods, and technologies, diffuse into the field and impact the adoption of sustainable design practices in architectural forms) .

The outlined theoretical and conceptual frameworks above offer different perspectives on how architectural education can impact energy sustainability. The choice of frameworks based on the set research objectives in this study sustainability pedagogy framework as conceptual framework while the chosen theoretical framework will be pedagogy and curriculum framework. In these frameworks, the impact of existing curriculum and methodology of teaching greatly influence the role architectural educations plays sustainable energy practices in buildings.

## **2.2 Evaluation of Architectural Education**

The academic architectural education evolves with the needs of each generation. In the ancient era, architectural education in Egypt was through the school for scribes' (free dictionary 1979 edition), while in ancient Greece it was through small private schools under the guidance of much more experienced Master Builders. In Roman civilization, architectural education involves the knowledge of geometry, astronomy, history, philosophy in addition to the building materials and the construction trades/elements. The guide shops and the monasteries are the centre for architectural education in the middle ages. The inauguration of the Academic d' Architecture in France on December 3, 1671 that later gave birth to Ecole de Beaux-Arts sets the standard and curriculum for the known architectural education today according to Alexander Giffi. The Academics of Fine Arts (17<sup>th</sup> and 18<sup>th</sup> centuries) allows architects to be trained with artists/ sculptors; but the higher technical schools of 19<sup>th</sup> century trained engineers that specializes in architecture. The emergency of schools of Architecture and professional bodies in 20<sup>th</sup> century gradually led to 1958 Oxford International Conference on architectural education; which was revisited in 2008 (50 years later) that laid the foundation for the unfolding architectural education of 21<sup>st</sup> century. Therefore, the tasks of architectural education in the 21<sup>st</sup> Century had gone beyond the basics (functionality, build ability and aesthetics) by including other vital issues of environmental sustainability to which energy usage and its efficiency had become a core value system.

## **2.3 Sustainable Energy in 21<sup>st</sup> Century Megacity**

Energy is sustainable if it meets the needs of the present without compromising the ability of future generation to meet their needs according to Wikipedia. Therefore, the tasks of architectural education in 21<sup>st</sup> Century include a deep insight to the basics of energy sustainability that will guide in architectural studio practices at any level of architectural practice. The greenhouse gas emissions as environmental aspects and energy poverty as socio-economic aspects of energy sustainability must be understudy; in addition to sustainable sources like wind, solar, hydro power, bio energy, geothermal, ocean energy and so on; and the means of making energy more sustainable like reducing, reusing and recycling, usage of innovative energy - efficient appliances. The existing challenges/prospects ahead, the thin line between sustainability and energy efficiency for economic development; effective measurement and its importance for developing countries are under areas of interest for architectural education.

The existing schools of architecture in Nigeria (as at 2022) are 104 including universities and polytechnics out of which 20 percent are either within Lagos Megacity or around. It

is the products of these schools that had, is and will shape the built environment of the emerging Lagos Megacity. It is therefore of importance to prepare them very well with all these required knowledge and skills to build this Megacity so that it can stand out among its common wealth.

The global megacities are characterized by high population densities, rapid urbanization and high level of energy consumption face significant challenges in promoting energy sustainability (Leichenko et al 2018). The building sector is a significant contributor to energy consumption in megacities, accounting for over 40 percent of energy in many cities (IEA, 2019).

Passive design, energy-efficient lighting and efficient HVAC system are energy-efficient building design strategies that helps significantly reduce energy consumption in building (Sarton, et al. 2015). Usually the adoption of these strategies in megacity is often hindered by factors such as inadequate policies, lack of public awareness and financial constraints. The promotion of renewable energy such as solar and wind can also contribute to energy sustainability in megacities (Wrong, 2016). However, the promotion of energy sustainability in megacity requires multidimensional approach that involves the adoption of energy-efficient building design strategies, the promotion of renewable energy sources and the implementation of policies that promote sustainably development.

Architecture plays a critical role in promoting sustainability by designing buildings that are energy-efficient and environmental friendly. The design of buildings can significantly affect energy consumption, greenhouse gas emission and the overall sustainability of cities. Passive design strategies, such as proper orientation, natural ventilation, and shading can significantly reduce energy consumption by reducing the need for artificial lighting and HVAC system (Heislbery, 2016). The building design that encourage stair usage in place of elevators can promote physical activities and reduce energy consumption associated with elevators (Vogel, et al., 2014). The incorporating of sustainable materials such as low-emission materials, recycled materials and materials with low embodied energy (Yang, et al., 2015) helps to promote energy sustainability.

#### **2.4 Impact of Architectural Education on Energy Sustainability**

Functional architectural education equips and impact students with skills, knowledge and attitudes to design energy - efficient buildings according to Hassain and Alzoubi (2021).

This is achievable by incorporating courses that cover topics such as passive design, energy-efficient lighting, efficient HVAC systems, and the use of renewable energy sources (Mora, 2021). These courses provide students with the knowledge and skills to design buildings that are energy-efficient and environmental friendly. The promoting of sustainable behavior among students by incorporating sustainable practices into design project (Kuuskorpi, et al. 2019), for example, studio project that require students to design building that incorporate passive design strategies can promote sustainable design practices among students. The incorporation of research on sustainable building design into architectural curriculum can provide students with a deeper understanding of the

environmental impacts of building design and the potential solution to reduce energy consumption and greenhouse gas emission (Ciribini, et al. 2018).

There are many approaches to teaching energy sustainability in schools of architecture, each with its own benefits and challenges. Some of these approaches identified in the literatures include: integrating sustainability into the design studio; incorporating sustainable design courses; utilizing experimental learning; collaborating with other discipline; and so on. By utilizing a combination of these approaches, schools of Architecture can help their students with the knowledge and skills needed to design energy-efficient and environmental friendly buildings.

### **2.5 Evaluation of Architectural Education on Energy sustainability**

There have been several studies that have evaluated the impact of architectural education on energy sustainability. These studies have used a variety of methods to assess the effectiveness of architectural education on promoting sustainable design principles. Some examples are outlined below: A study by Pfluyer and Woloszyn(2015) evaluate the impact of a sustainable design course on the energy efficiency of student designs. The study found out that student who took the sustainable design course produced designs that are significantly more energy efficient than those who do not take the course. Another study by Rakhshandehwo, et al. (2018) evaluates the impact of a sustainable sustainability. The study found out that student who took the sustainable design courses had significantly more positive attitudes towards sustainability than those who did not take the course. A study by Sharifi and Murakami (2010) evaluated the input of sustainable design education on the attitudes and behaviors of practicing architects. The study found out that architects who received sustainable design education were more likely to incorporate sustainable design principles in their practice than those who did not receive such education.

A study by Tezel and Azemati (2016) evaluated the impact of an integrated sustainability courses in the design projects of architectural students. The study found that students who took this course produced designs that were significantly more sustainable than those who did not take the course.

Overall, these students suggest that architectural education can have a positive impact on energy sustainability by promoting sustainable design principles and attitudes towards sustainability. However there is the need for further research to evaluate the long term impact of architectural education on energy sustainability and to identify the most effective approach to teaching sustainable design principles.

### **3.0 Methods**

This study adopted quantitative approach of data collection using a well-structured questionnaire randomly distributed among students of selected architectural schools in the Lagos Megacity. The data was analyzed using Statistical Package for Social Sciences (SPSS) to evaluate the objectives.

#### 4.0 Results

The study was conducted among architectural students of selected schools of architecture in Lagos Mega City. Results as shown in Table 1 shows that 71.3% are male while 26.9% were female 1.9% did not identify their sex. Also, 65 respondents are Undergraduate students (60.2%), 41 respondents were Masters Students (38.0%) while both Graduate and PhD student were 1 respondent each accounting for 0.9%. Finally, the majority of the sampled respondents were from Caleb University 83.3%, 7.4% are from University of Lagos, 6.5% from Olabisi Onabanjo University, Ago-Iwoye and 2.8% from other universities within Lagos Mega City.

**Table 1: Respondents' demographic characteristics.**

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male	77	71.3
Female	29	26.9
Total	106	98.1
System	2	1.9
<b>Total</b>	<b>108</b>	<b>100.0</b>
<b>Current level</b>	<b>Frequency</b>	<b>Percent</b>
Undergraduate	65	60.2
Graduate	1	.9
Masters	41	38.0
PhD	1	.9
<b>Total</b>	<b>108</b>	<b>100.0</b>
<b>School of Architecture</b>	<b>Frequency</b>	
Caleb University, Imota	90	83.3
Olabisi Onabanjo University, Ago-Iwoye	8	7.4
University of Lagos, Lagos	7	6.5
Other	3	2.8
<b>Total</b>	<b>108</b>	<b>100.0</b>

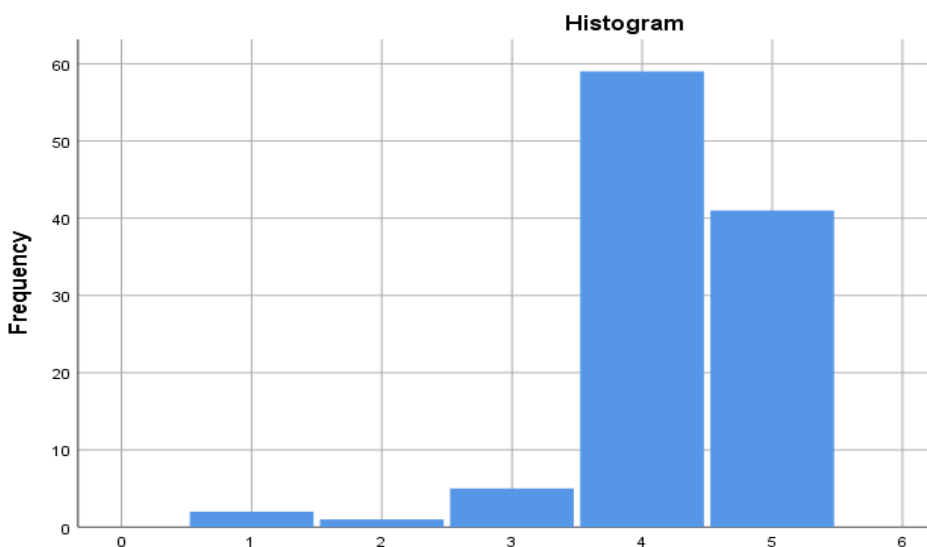
Source: Authors field work 2023

The first objective evaluated influences of architectural education in building design and construction with respect to energy sustainability in the study area and from Table 2, 7.4% disagreed that architectural education had influence on building design and construction while 92.6% agreed that architectural education had influence on building design and construction. A graphical representation is shown in figure 1.

**Table 2: Influences of architectural education on building design and construction**

	Frequency	Percent
Strongly Disagree	2	1.9
Disagree	1	.9
Neither agree nor disagree	5	4.6
Agree	59	54.6
Strongly Agree	41	38.0
<b>Total</b>	<b>108</b>	<b>100.0</b>

Source: Authors field work 2023



**Figure 1: Influences of architectural education on building design and construction**

**Table 3: Influence of Institutional bodies on architectural education**

				Review ing of the existing policies at govern ment and instituti onal	The Nigerian Institute of Architect s (NIA) is one of the Institutio nal Stakehol ders	Architects Registration Council of Nigeria (ARCON) is one of the Government agencies that should be at the forefront of the formation.
Influence of Institutional policies on design and construction school of Architecture	Pearson Correlatio n	1				
	Sig. (2- tailed)					
	N	103				
Reviewing of the existing policies at government and institutional	Pearson Correlatio n	.029	1			
	Sig. (2- tailed)	.775				
	N	102	102			
The Nigerian Institute of Architects (NIA) is one of the Institutional Stakeholders	Pearson Correlatio n	.099	.292**	1		
	Sig. (2- tailed)	.318	.003			
	N	103	102	103		
Architects Registration Council of Nigeria (ARCON) is one of the Government agencies that should be at the forefront of the formation.	Pearson Correlatio n	-.064	.187	.609**	1	
	Sig. (2- tailed)	.522	.060	.000		
	N	103	102	103	103	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Finally, the last objective evaluated the influence of institutional bodies on architectural education and the results showed that there is a significant influence of the Institutional bodies ranging from government policies to regulations from Nigerian Institute of Architects and Architects Registration Council of Nigeria. The government policy



showed a significance of .292 (29.2%) with Nigerian Institute of Architects while Architects Registration council had a significant influence of .609 (60.9%). Table 3 shows the various relationships among the policies.

## 5.0 Conclusion

This study concludes that architectural education had influence on building design and construction in the school of architecture especially in Lagos Mega City. Also, that government policies had a far reaching influence on Nigeria Institute of Architects and Architects Registration Council who eventually regulates the schools of Architecture. Therefore, issues of sustainability and development should be included in architectural school for energy sustainability.

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