The Prospects and Challenges of incorporating Earth Construction Techniques (ECT) in the Nigerian Educational Curriculum

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***Abstract*—This paper is aimed at examining the prospects and challenges of incorporating Earth Construction Techniques (ECT) in the architectural curriculum of tertiary institutions in Nigeria. It presents significant findings on the role of sustainable practices, architectural design and green materials utilization as key factor in the training and educational development of the future generation of Nigerian architects. Furthermore, the *Bloom Taxonomy* (BTX) was employed to evaluate the challenges and prospects of ECTs in Nigerian tertiary education curricula. The authors conclude that the prospects of implementing BEM and ECTs into the curricula of Nigerian institutions will increase awareness about matters of environment sustainability, architectural design and green construction materials. The process will also avail the nation with as alternative building materials, skilled jobs, and the prospects of collaboration between industry and academia. Conversely, the study also identified a number of challenges that can potentially hamper the integration of ECTs into the curricula of Nigerian tertiary institutions.**

Keywords—Earth; Construction; Educational; Curriculum; Nigeria.

I. INTRODUCTION

Building earth is an indigenous material widely used in traditional African societies for the production of household utensils, traditional cosmetics and building materials [1-3]. The use of building earth materials (BEM) for construction in Nigeria is gaining prominence due to its strength, durability and affordability [3-5]. The application of BEM and its integration for the construction of buildings, known as Earth Buildings (EBs), is simple, cheap and does not require sophisticated machinery. It can prevent pollution, deforestation, and loss of biodiversity thereby presenting an environmentally friendly and sustainable alternative to conventional building materials [6]. In general, Earth Buildings (EBs) are also characterized by low energy costs throughout their lifetime from cradle to grave. However, EBs are labor intensive and more time-consuming than conventional design and construction materials [3].

The application of local building materials in the construction industry is considered a cost effective, renewable and sustainable approach to managing the planet's natural resources [7-10]. This is vital particularly in developing countries like Nigeria striving to meet the Millennium Development Goals of the United Nations. Furthermore, socioeconomic growth and sustainable development in developing countries can be enhanced by the integration of sustainable design practices, green buildings, waste materials valorization and energy saving technologies [11-15].

Consequently, Earth Construction Techniques (ECT) which exploit "Earth" building materials have become commonplace around the globe. Scientific studies indicate that almost 50% of the world's population, predominantly rural dwellers reside in EB, although this is no longer a phenomenon akin to the developing world [6, 16]. Consequently, EBs can be found in the UK, Germany and France where over 500,000 exists on record. In addition, around 15% of the population in France resides in earth-walled houses while a significant proportion of houses in Australia's Margaret River province are housed by unfired earth walls [17, 18].

Incidentally, construction with earth materials has increased substantially over the years particularly in United States and Brazil, largely due to the sustainable construction programs [6]. However, the adoption and integration of Earth Materials and Earth Construction Techniques (ECT) into modern buildings construction in Nigeria is significantly low despite is social, economic and environmental merits. According to researchers, this can be attributed to lack of awareness, training and education [19], principally on issues of architectural design, sustainable practices

and environmentally friendly building materials utilization.

As a result, designers and architects aim to avert the negative environmental consequences of anthropological actions by adopting innovative architectural design and sustainable practices into the educational curriculum. According to Ali *et al*., (2010) lack of a sustainable architectural curriculum for higher educational institutions in Nigeria may be responsible for lack of integration Earth Construction Techniques (ECT) in Nigeria. In addition, the study also highlighted the lack of agencies responsible for promoting sustainable architectural educational issues and programmes.

Therefore this research is an attempt to examine the prospects and challenges of incorporating Earth Construction Techniques (ECT) in the curriculum of Architectural schools in Nigeria. It will highlight the importance of architectural design and sustainable practices as key factor in the training and educational development of the future generation of Nigerian architects.

I. EDUCATION AND ARCHITECTURE CURRICULUM

The term education has been defined by different scholars and philosophers. Hence, there is no distinctive definition of education as the concept has been exposed to different and often contradictory interpretations. The term education is derived from the Latin word "*educere*" meaning to "lead out", or "bring out" [20]. But another school of thought refutes this, instead claiming "*educare*", which means to "form" or "train" should suffice [21]. The UNESCO International Standard Classification of Education (1995) defines education as comprising organized and sustained communication designed to bring about learning [22].

However, the dawn of industrialization has increased the demand for educational knowledge and skills over the years. Education is now associated with "schooling", "training" and "instructions". In addition, the current pace of socioeconomic growth and technological development has led to the rapid depletion of the earth's natural resources resulting in grave concerns about environmental sustainability.

Hence there is an urgent need for the adoption and integration of sustainable practices and green technologies for the efficient utilization of the earth's natural resources. The current crop of educators, academics and scholars are consequently tasked with integrating sustainable teaching into the existing curriculum to cater for the evolving needs of the society, academia and industry.

This will foster the entrenchment of educational concepts and precepts into professional practices and the behaviour patterns of the future generation of architects in Nigeria. Furthermore, this will create dynamic medium for comprehending the complex multidimensional concepts of sustainability from a sociotechnological standpoint and encourage its integration into educational curricula [23].

According to the study by Sahlberg (2011), there appears to be no fixed definition of curriculum [24]. The term "curriculum" is derived from the Latin word "*currere*" which means to "run". As Sahlberg notes, curriculum in the context of Anglo-Saxon countries, refers to what students ought to learn within a framework of goals, objectives, content and pedagogy. Additionally, curriculum is "concerned with what is planned, implemented, taught, learned, evaluated and researched in schools and at all levels of education" [25].

According to De Coninck (2008), curriculum, more than ever before, is now viewed as being at the centre of daily life and the responsibility of the entire society [26]. The study by Levin (2007) examined the complexity of educational change and notes that "as governments have attempted to make large-scale changes," curriculum change has become "less of an activity in its own right" and curriculum renewal has become part of a broader strategy for educational change [27].

The concept of educational change can be attained by the establishment of learning objectives and goals. This is typified by the so called "*Bloom's Taxonomy*" (BTX) which categorizes learning objectives within an educational system as proposed in 1956 by a committee of educators chaired by Benjamin Bloom. The first volume "*Bloom's Taxonomy*" outlines the different learning objectives, curricula design and examinations, and modalities for effective communication between educators and students as typified in Figure 1 [28].

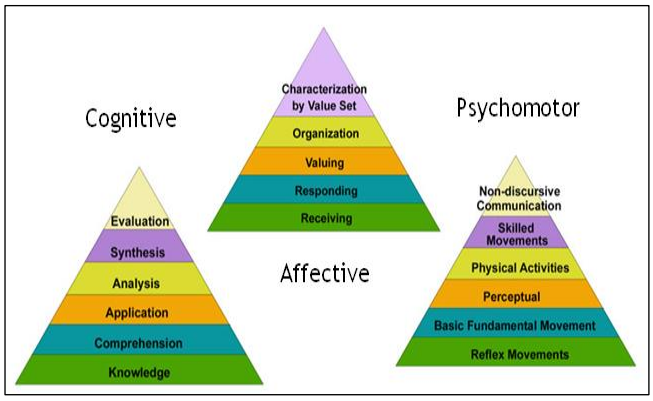

Figure 1: Domains of Bloom's Taxonomy [28].

According to the ideals of BTX, the creation of a comprehensive curriculum for education change requires a combination of cognitive, affective and psychomotor factors. The fusion of these factors can enable educators effectively design the requisite educational curricula for efficient delivery of educational instructions to their students. The universality of learning suggests BTX can be applied to architectural studies particularly in a developing countries like Nigeria where educational development is at a crossroads. Hence the next section of this paper will highlight the prospects and challenges of implementing Earth Construction Techniques (ECTs) into the Curriculum of Nigerian Architectural Schools based on BTX.

II. DISCUSSION

A. PROSPECTS OF IMPLEMENTING ECTS IN NIGERIA

The prospects of implementing building earth materials (BEM) and Earth Construction Techniques (ECTs) in tertiary institutions will not only improve the educational curriculum in Nigeria but also reiterate the significance of environmental sustainability, architectural design and green materials utilization in the wider context of societal needs. According to studies by Siddiqi (2002) and Elliot (2003), architectural courses like design studio can stimulate intellectual and intuitive aptitude as well as creative, technical and physical skills among students. In addition, these courses can improve the development and diffusion of knowledge for the design of future architectural curricula [29, 30]. According to BTX, this is vital for creating reliable and cohesive learning methods aimed at motivating the cognitive, affective and psychomotor development in students.

In the Nigerian context, the implementation of ECTs into architectural curricula will increase awareness on matters of environment, sustainability and construction materials. The utilization of building earth materials (BEM) and implementation in Earth Construction Techniques (ECTs) has numerous advantages to the building and construction industry in Nigeria. The advantages of BEM include; low cost of materials, low energy and transportation costs. BEM is a fire resistant, renewable and environmental friendly resource which can be easily be implemented and recycled after use. Furthermore, BEM provide natural warm texture and colors that helps maintain a balanced indoor climate without extremes of temperature, sound and other external interferences [3, 31, 32].

Hence, BEM materials and ECTs avails educators, academics and scholars with the tools to establish a comprehensive multidisciplinary curricula for teaching sustainable architecture in the future. According to Gürel (2010), this will effectively guarantee the appreciation of sustainable environmentally responsible design as imperative to the curricula of architectural education [23]. From a socioeconomic perspective, BEM affords professionals in the building and construction industry with low cost, renewable and sustainable alternatives to conventional building materials.

With such prospects, increased funding for academic research into BEM and ECTs will increase in Nigeria. This will consequently enhance greater collaboration between the academia and industry in the country. Furthermore, the implementation of novel innovations BEM and ECTs will directly or indirectly create long term jobs for both skilled academics, researchers, craftsmen, artisans and other professions. In general, the vocation skills and technical education will greatly benefit from BEM and

ECTs integration and adoption in the Nigerian higher institutions curricula in the future.

B. CHALLENGES OF IMPLEMENTING ECTS IN NIGERIA

The challenges of implementing Earth Construction Techniques (ECTs) in Nigerian tertiary institution curricula will be discussed in this section of the paper. In spite of the outlined merits of implementing ECTs, the utilization of building earth materials (BEM) is plagued by a number of challenges which can directly and indirectly affect is its implementation in tertiary education curricula in Nigeria.

Firstly, the use of BEM is time consuming, requiring long construction periods and prone to weather constraints. Further health, safety and regulatory guidelines require extensive soil tests, calculations, and reports to meet building and industry standards. Furthermore, the use of BEM often requires customized design efforts due to intrinsic material limitations, e.g. wall heights, the size of openings for windows and doors, or necessary roof overhangs to provide weather protection.

These challenges require a substantial revision of course curricula in tertiary education to cater for BEM materials which the curricula in Nigerian tertiary institutions lack. In addition, the implementation of BEM and ECT will require the establishment and strict of health, safety and environmental regulations to ensure the wellbeing of the inhabitants of EBs. In the absence of such regulations, BEM and ECTs cannot be applied in school curricula.

Another major challenge to BEM and ECTs implementation and integration will the lack of awareness of the multidimensional concepts of sustainability and the dynamics of environmentally responsible design. This will require comprehensive training, skills acquisition, and enlightenment to equip educators, trainers and academics in Nigeria on the future prospects of BEM and ECTs. Consequently, the process of implementing ECTs based on BEM into the curriculum of Nigerian tertiary institutions will require a re-evaluation teaching methods, learning objectives and course content delivery to future students. The current clime of blackboard-classroom teaching and theoretic dissemination of academic knowledge has to evolve into more practical approach for rapid skills assimilation.

According to “Bloom's Taxonomy” (BTX) domains of learning require cognitive, affective and psychomotor are necessary to successfully stimulate educational change in any learning environment. The cognitive domain is will entails a change in the methods of evaluating, synthesis, analysis of the entire knowledge and comprehension of course curricula for architecture in Nigerian tertiary institutions.

The affective domain requires stimulating the reasoning attitude and interest of educators as well as students towards BEM and ECTs development, integration and diffusion. The psychomotor domain of BTX learning necessitates physical activities, fundamental and reflex movements to stimulate learning. In totality, the coordination of all three domains will ensure the integration of ECTs into the

curriculum of architecture in tertiary education in Nigeria.

III. CONCLUSION

The prospects and challenges of integrating Earth Construction Techniques (ECT) in the curriculum of Architectural schools in Nigeria was examined in this study. The significance of sustainable practices, architectural design and green materials utilization as key factor in the training and educational development of the future generation of Nigerian architects was highlighted. The study suggests that the prospects of implementing BEM and ECTs into the curricula of Nigerian institutions can increase awareness on matters of environment, sustainability and construction materials as well as alternative building materials, jobs, and collaborative funding for future R&D projects research. Finally, the study identified the challenges that can potentially hamper the process of ECTs curricula integration in Nigerian institutions.

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