PROMOTING ICT AND DIGITAL EDUCATION IN PUBLIC SCHOOLS IN LAGOS, NIGERIA USING AFFORDABLE CLEAN ENERGY SOLUTIONS

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Abstract

Goal 4 of the United Nations Sustainable Development Goals (SDGs) aims to ensure inclusive and quality education for all including the promotion of lifelong learning. Hence the goal seeks to promote development of the human person through education. This development is best driven by technology through the application of Information and Communication Technology (ICT) to digital education. The challenges posed by COVID-19 have further made virtual education which is dependent on the acquisition of ICT and digital skills very imperative. Incidentally, technology based education is dependent on the availability of energy which cannot be guaranteed in a developing country context such as Nigeria. Hence, this study is aimed at examining the energy supply situation in selected public secondary schools in Lagos, Nigeria and their coping strategies for ICT and digital education. The study adopted the qualitative approach with data obtained from observation and interviews. The study found that the schools relied mostly on conventional electricity supply from the national grid which was generally epileptic and unreliable. The schools had standby electricity generators to support mains supply and this is a major source of pollution and carbon emissions. The study thus recommended the use of renewable clean energy systems such as solar electricity through photovoltaic cells to power the equipment used for ICT and digital education.

Keywords: Clean energy, digital skills, public schools, Lagos Nigeria.

1 INTRODUCTION

Education remains a veritable foundation for human and economic development. This is because education facilitates upward socioeconomic mobility which often leads to eradication or reduction of poverty [1]. Goal 4 of the SDGs of the United Nations underscores the importance of education to overall sustainable development and several successes have been recorded in this regard. Even with the progress made so far in inclusive education, it has been estimated by the UNESCO Institute for Statistics (UIS) that as at 2018, about 260 million children were still out of school [2]. Most of the out-of-school children are found in developing countries and Nigeria accounts for a sizeable proportion [3, 4]. Most of the affected children and youth are found in areas ravaged by civil strife and terrorist activities especially in the northern part of Nigeria.

In positioning education as a driver of development in the 21st century especially in the developing countries, technology-based education holds the key. Technology-based education stresses the value of technology in promoting education. It integrates instructional technologies such as the computer and the internet into the learning environment of schools. Hence, technology-based learning (TBL) incorporates learning using electronic technology, including the Internet, intranets, satellite broadcasts, audio and video conferencing, bulletin boards, chat rooms, webcasts, and CD-ROM [5]. TBL has also been referred to as E-learning, virtual learning, online learning, web-based learning and computer-based learning.

The Nigerian National Policy on Education gives priority to science and technological education [6]. This policy is further reinforced by the National Policy on Science and Technology [7]. In addition, the National Policy on Science, Technology and Innovation (STI) has a component that deals with promotion of technology-based education through curriculum and other interventions such as provision of physical facilities [8]. In order to realize the educational objectives of the Nigerian government, the operational education system is the 6-3-3-4 system which means six years of primary education, three years of junior secondary education, three years of senior secondary education and a minimum of four years of university or other tertiary education [9]. However, with the advent of the Universal Basic Education (UBE) programme, the first two tiers were merged which gave rise to the 9-3-4 system where basic education takes nine years while secondary and tertiary education take three and four years respectively. In reality, however, the two-tier secondary education structure is most

prevalent in Nigeria. Hence, the schools under consideration in this study belong to the secondary category. As a result, the study will cover both junior and senior secondary schools.

In spite of the foregoing laudable objectives, poor implementation, inadequate funding and inadequate teaching aids have combined to make the goal of technological advancement through education largely unachieved at the moment [10]. ICT and digital education is at the core of technology based education. The adoption of ICT and digital based education has been slow in the Nigerian educational system. A number of reasons have been adduced for this. According to [11], the low level of adoption can be ascribed to policy deficiencies, implementation challenges and poor information and related infrastructure.

The COVID-19 pandemic has brought to the fore the need for more options in the instructional mode of schools. The impact of COVID-19 on children has been quite profound in many respects. Of particular interest is the impact on education. The pandemic led to the total closure of schools in 188 countries putting into jeopardy the educational aspirations of over 1.5 billion children and youth [12]. The online instruction mode has recommended itself in the aftermath of the first pandemic in the last 100 years. The online teaching and learning platform has provided opportunities for school instructions to continue even during the pandemic.

Even though online teaching and learning were introduced in about two thirds of countries, it was only prevalent in about 30% of developing countries, thus further widening the digital divide [12]. Prior to the pandemic, about a third of the world's young people were already excluded from digital education due to poor infrastructure and low access to the internet [12]. Moreover, the physical distancing and lockdown requirements for containment of the pandemic resulted in suppressed economic activity levels, leading to recession and reduced family income. Incidentally, digital education is not cheap and requires investment in electronic devices, internet services and in energy infrastructure. Hence, reduced family income is further depleted in the attempt to provide additional learning tools. Even with partial reopening of schools in some countries, online or digital education may still be useful as a way of covering lost ground in school curricula. Hence, a combination of both online and in-person instruction may become a trend in the future even when COVID-19 is finally brought under control. It could also be very useful in making education available to areas where physical in-person instruction may not be possible.

The energy aspect of critical infrastructure in aid of digital education is worth investigating as it is central to the adoption of technology based education. In this respect, the most usable form of energy is electricity which can be generated from both renewable and non-renewable sources. In general, electrical and other energy costs are significant aspects of the cost of running schools. The significance lies more in the fact that even though energy cost is a distant second to personnel costs in school expenditures, it presents a better opportunity for substantial cost and carbon footprint reduction in the management of schools [13, 14]. In addition, energy savings potentials exist for all energy end uses such as lighting, air cooling and equipment powering [15]. Hence, it has been estimated that energy efficiency features and adoption of renewable energy options present a good opportunity for cost reductions of up to 25% [14].

Electrical energy supply in Nigeria is largely inadequate and inefficient. Electricity access in Nigeria stands at about 60% as at 2018 [16]. In addition access disparity exists between urban areas (86%) and rural areas (34%), according to [16]. Comparatively, the per capita electrical energy consumption of about 126Kwh in Nigeria is very low when compared with that of Ghana (361Kwk) and South Africa (3926Kwh) as indicated by the Advisory Power Team [17]. As a result of inadequate supply of needed electricity and given that many consumers including schools are excluded from supply from the national grid, experts are recommending off grid renewable energy especially for schools to facilitate ICT based education. This will also mitigate shortfall in grid supply in urban areas where there is grid access but limited supply of electricity. This is underscored by the fact that about 65% of schools in Nigeria lack access to electricity [18].

In addition, current grid electricity mix in Nigeria is lopsided in favour of carbon intensive sources. Hence, in order to increase energy access especially at the schools while at the same time promoting low carbon energy sources, in accordance with the Paris Accord on reduction of greenhouse gas (GHG) emissions, there is need for recourse to clean renewable sources such as solar and wind energy. GHG emissions are responsible for climate change. Already, the Nigeria Renewable Energy Master Plan [19], Renewable Energy and Energy Efficiency Policy [20] and the Renewable Energy Action Plan [21], target the installation of 500MW of solar electricity by the year 2025. The main objective is to increase renewable proportion of the electricity mix from 13% in 2015 to 23% in 2025

and 36% in 2030. The movement towards low-carbon electricity is a desirable and sustainable direction [22] and clean energy for schools is a way to go.

Public secondary schools in Lagos are well established and are usually preferred by low income parents and students due to low associated costs. Even though private school enrolment is substantial and increasing steadily in Lagos State, public schools accounted for about 67% of school enrolment as at 2016 [23]. This implies that the public schools are well populated which affects the energy requirement of running the schools. Meanwhile, the general state of the public schools has been adjudged to be poor and requiring intervention. As a result, government has embarked on massive renovation of public school facilities. Given the above scenario, and bearing in mind the additional demands for virtual education in the pandemic, it is necessary to examine the state of the facilities at the public schools to ascertain readiness for education via the virtual platform. Specifically, the paper addresses the following research questions:

1 What are the components of the school renovation programme and how do they impact on ICT and digital education

2 What are the major sources of conventional and alternative electrical energy for school operation?

3 Are there opportunities for installing renewable energy fittings in the school buildings?

2 METHODOLOGY

The research is qualitative. Data was obtained from secondary sources as well as through the use of observation schedules and interview guides. Lagos State has a decentralized structure for managing secondary schools based on the schools management reforms introduced in 2005 [24]. Hence there are six education districts (District I – District VI), details of which are provided in Table 1. One school in good physical standing was selected from each of the education districts for the exploratory study. The selection was based on the physical conditions of the school buildings as well as school enrolment figures. School buildings that have been constructed or renovated between 2010 and 2019 were considered in order to maintain some level of currency for the buildings.

Table 1: Education Districts and Local Government Coverage

s/no	*Districts*	*Local Governments*	*Headquarters*
1	District I	Agege, Alimosho, Ifako/Ijaiye	Dairy Farms Primary Schools Complex Agege
2	District II	Ikorodu, Kosofe, Shomolu	Maryland Schools Complex, Maryland
3	District III	Epe, Eti-Osa, Ibeju-Lekki, Lagos Island	St Gregorys Primary School. 123 Awolowo Road Ikoyi
4	District IV	Apapa, Surulere, Lagos Mainland	Domestic Science Centre. 8 McEwen Road, Sabo-Yaba
5	District V	Ajeromi-Ifelodun, Amuwo-Odofin, Badagry, Ojo	Agboju Schools Complex, Agboju
6	District VI	Ikeja, Mushin, Oshodi-Isolo	Schools Complex, Ewenla Street Charity Oshodi

Source: Adapted from [24].

The selected schools were subjected to observations while the school heads were interviewed to find answers to the research questions. The construction and renovation of public school buildings in Lagos is handled by the Special Committee for Rehabilitation of Public Schools (SCRPS), under the State Ministry of Education. In order to ensure that the newly constructed and renovated school buildings are kept in good state of repair, Facilities Managers are being posted to the schools. The energy supply aspect of the school infrastructure improvement scheme is facilitated by the Lagos Solar Power project under the Lagos State Electricity Board (LSEB). Secondary data were obtained from the relevant agencies involved in the management of the schools and the provision of required facilities for the schools.

3 RESULTS

3.1 Building Components

It is generally agreed by relevant stakeholders that facilities for public education need to be upgraded. Lagos State Government agrees with this position and has over the years committed resources for the upgrade of the schools through renovation and construction of new school buildings. Majority of the public schools in Lagos were in the 1980s, which means that the bulk of school buildings are between 30 and 40 years old. The school buildings were hurriedly built to fulfill the free education programme of the Lagos State Government after the return of Nigeria to democratic rule in 1979. However, with time and little attention paid to maintenance, the buildings fell into disuse. The renovation efforts of the government with respect to school facilities have focused mainly on the external envelope of the buildings as well as on supply of furniture and fittings. The building envelope components in this regard are the roof, doors, windows and walls.

3.1.1 The Roof Component

The roof structure of the earlier school buildings was made of timber while the roof covering was asbestos-cement roofing sheets. However, with time, the timber suffered either from pest attack or decay while the roofing sheets got broken. In the renovation, long-span aluminium roofing sheets were used to replace fiber-based asbestos-cement roofing sheets. Metal based roofing sheets last longer than the asbestos sheets. However, metal based roofing sheets admit more heat to the interior. Moreover, asbestos has fallen into disuse because of the link with health challenges. However, most of the renovated roofs retained their timber structural framework.

3.1.2 Doors and Windows

Prior to the on-going renovations, the windows were mostly made up of glass louvre blades on galvanized steel louvre carriers which in turn were screwed to timber window frames. A number of them had timber window shutters while another fraction was built without windows. According to some respondents, the windows were easily vandalized and soon got dilapidated. Hence, in the renovation, steel casement windows were used to replace glass louver windows and wooden shuttered windows, especially on the ground floor of the school buildings. Office areas and common spaces had aluminium framed glass sliding or casement windows. Steel doors were also used to replace wooden doors.

3.1.3 Walls

Similarly, both external and internal walls were built with sand-cement masonry work which were rendered and painted. However, brick facing is increasingly being introduced as wall finishing material to reduce the frequency of repainting external wall surfaces.

3.1.4 School Fence

Another prominent feature of the school upgrade programme is the erection of perimeter fence walls for the school premises. Prior to this, most school premises were not properly delineated. As a result, the schools were often not secure and a number of serious security breaches have been witnessed. The fence walls were fitted with watchtowers, floodlights and panic bells to make the schools more secure. The fence walls were also finished with brick facing in order to minimize the frequency of maintenance.

From the foregoing, it may be inferred that the school upgrade programme was mainly to create a conducive and secure school internal and external environment which will facilitate sustainable inputs into the school system. The ICT infrastructure needed to drive improved learning can only be possible in a secure and conducive school environment.

3.2 Energy Supply to the Schools

The schools are all connected to electricity from the national grid. However, the electricity supply is epileptic and inefficient. As an immediate alternative, the schools have standby electricity generators which are powered by carbon intensive premium motor spirit (PMS) and diesel, also known as automotive gas oil (AGO). An emerging trend however is the adoption of renewable energy especially solar photovoltaic panels and associated components as a significant provider of electricity. Using the

instrumentality of the Lagos State Solar Power project, the Lagos State Electricity Board has provided solar electricity to about 172 schools. However, this number represents just about 25% of the public secondary schools in Lagos State. So far the Lagos Solar project is limited to the provision of stand-alone off-grid systems.

3.3 Opportunities for Renewable Energy Installations

Most of the school sites are good for installation of renewable energy equipment especially solar photovoltaic (PV) panels. Even though urban schools are located within built-up urban areas, the relative area of the school premises in comparison to adjoining premises allows for installation of renewable energy especially solar installations without obstructing shadow from adjoining buildings. Similarly, the average height of the school buildings is three floors which make them stand out within the neighbourhood. The roof footprint is also large enough to accommodate the required number of solar PV panels. However, it is advisable to replace timber roof structure with structural steel roof structure for public schools given that steel is more durable.

4 CONCLUSIONS

It can be understood from the foregoing that the school renovation programme is holistic and multi-sectoral, involving different sections of government. The renovation proper which focused mainly on the building envelope has not incorporated any clean energy initiatives but has nevertheless provided a framework for the installation of clean energy sources in the public schools. Altogether, about 25% of public schools in Lagos State have access to clean solar electricity. Opportunities for installation of more solar PV panels and accessories abound in Lagos State public schools given their favourable height and roof footprint. However, the preference for standalone off grid systems may be less efficient in the long run. The promotion of mini grids for the school and surrounding community may be a more sustainable and cost effective option due to the derivable economies of scale. Hence clean energy can be used to mitigate the digital divide by proving affordable energy to power technology based education while at the same time curtailing GHG emissions associated with conventional and alternative electricity generation in the study area. Clean energy adoption will also help in inculcating sustainability principles in young people thereby building capacity for tackling future climate change related issues.

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