

Impact of Solar Power System on Academic Performance of Science and Technical College Students in Makurdi Local Government Area of Benue State

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ABSTRACT

The study investigated the impact of solar lighting system on academic performance of Science and Technical College students in Makurdi Local Government Area of Benue State. The population of the study was 410 respondents comprising of all the part two and three students of Electrical Engineering related trades of Science and Technical Colleges and their instructors in the study Area. Using stratified random sampling technique, 25 students were each selected from part II, III; while 5 instructors were also drawn from each of the two Science and Technical Colleges located in Makurdi Local Government Area of the State. A total of one hundred (100) electrical students and ten (10) instructors therefore formed the sample size for the study. Three research questions guided the study. Mean responses were used in answering the research questions. Findings revealed that there are no solar lighting system facilities in any of the hostel, classroom, library, laboratory or workshop of the two schools under investigation. Respondents however, agreed that they have solar lighting facilities in their homes that enable them prepare for their studies. Finding also revealed that solar lighting system impact on the academic performance of learners. The study recommended among others that governments, stakeholders in education and individuals should provide solar lighting system facilities in hostels, classrooms, libraries, laboratories and workshops of Science and Technical Colleges. This will to solve the problem of incessant power failure in schools which leads to poor study habits. This will enable students and teachers to have access to light in order to do their assignment and do their home preps before going to bed.

Keywords: Solar Power System, Academic performance

INTRODUCTION

It is globally acclaimed that academic achievement of students is predetermined by the efforts put into the learning process by individuals to comprehend learning activities presented to them in the course of their study. In order to achieve high academic standard in schools, researchers have advocated for ways of improving the learning environment for both teachers and students. One of the ways is to improve the lighting systems so as to enable students and teachers to work into long hours without hitches or stress in order to clear a backlog of work.

Lack of adequate lighting system critically undermines students' ability to study in the evening and consequently inhibits their academic performance in the classrooms. Most cities or towns in Nigeria with Makurdi inclusive, lack constant power supply and even when it is available; it hardly meets up the available load demand of the consumers. The resultant effect is the unfinished assignment leading to poor performance in class.

In science and technical colleges, leaning involves both theory and practice. Practical activities mostly require machines, tools and equipment that use electrical energy for their operations. The challenge of inadequate power supply to these science and technical colleges in Nigeria poses a serious problem in carrying out the desired learning activities. Even when the practical learning activities do not require electrical energy to power the tools and equipment, visibility during experimental procedures, students' and teachers' comfort using electrical energy may be very crucial.

Some school administrators have resorted to the use of standby generators to power their classrooms, laboratories and other school facilities. However, in the depressed economy like Nigeria, fueling of generators is cost intensive and also poses serious health consequences. This has recently amplified the call for solar energy system which is fuel free and cost effective for use in school environments.

Solar energy system is an efficient method of providing illumination and electrical energy for better visibility and operations of electrical utilities which improves learning and healthy leaving conditions in schools and homes. It is a photovoltaic (PV) module that collects energy from the sun and stores it in batteries to operate the required wattage of light and other related electrical gadgets connected to the system (Smith, Radestsky and Yue, 2010). This is generally used for energy savings, cost savings, and environmental reasons. This system is called grid free or stand-alone meaning that it can generate its own electricity at a specific site.

Recently, more experts in education and various solar light enterprises have added their voice in advocating for the provision of solar power system in educational institutions (Achilla, 2014). These experts believe that bright and clean light can enhance learning by students than the student's use of kerosene-based lighting for their activities. Todd and Ralph, (2007) disclosed that about 800 million children across the globe with emphasis on Africa

lack access to reliable lighting and rely on dim kerosene candles as their main source of lighting. This inhibits their study through dimness, indoor air pollution, fire risks, and high marginal cost of usage that makes parents unwilling to provide ample kerosene. An abundance of qualitative evidence suggests that solar lamps can be a potential solution to improving the poor household and school study environments prevalent in Nigeria generally and particularly in Benue State where electricity is epileptic, unreliable and unavailable.

Solar lighting in school buildings significantly affects students performance. The majority of schools generally do not provide adequate lighting to encourage the circadian system. Therefore, incorporating sufficient solar power system into school buildings will improve circadian stimulation and entrainment (Glewwe, Nauman and Kremer; 2003). According to Wittkopf, Yuniarti and Soon(2011), in well designed interior zones, solar light increases visual quality and mental health benefits, which are costly and hard to reproduce through artificial lighting.

Studies by International Energy Agency on Solar Lighting (2011) found that solar lighting improves visibility, comfort and health in working environments of students in schools. Similarly, Anderson (2009) identifies lighting as one of the most important factors for a positive learning environment. According to Fryer and Roland (2010), the relationship between functional learning area and electrical power supply is usually one of the optimal conditions that provide a good background for high-quality learning in school environment.

Studies on solar lighting and its effect on students' academic performance conducted by many researchers (Kremer, Edward and Miguel, 2009; Angrist, and Victor , 2009; and Fryer, 2010) revealed that Solar lighting significantly improves the test scores of students, improves classroom conditions, promote students learning, promotes students academic performance and reduce the rate of absenteeism in classroom.

These researchers therefore suggested that solar power system be used in school environment to enhance student's capacity in learning. It is therefore, the interest of these researchers to investigate the impact of solar lighting system on academic performance of Science and Technical College Students in Makurdi Local Government Area of Benue State.

Research Questions

The following research questions were sought and answered.

1. To what extent are solar power system facilities available for Science and Technical College Students?
2. What is the level of utilization of solar power facilities by students in homes or school environment?
3. To what extent does the use of solar power system affect academic performance of Science and Technical College students?

METHODOLOGY

A cross sectional descriptive survey research design was used for the study and the area of the study was Makurdi Local Government Area of Benue State. The population of the study was 410 respondents comprising of all the part two and three students of Electrical Engineering related trades of Science and Technical Colleges and their instructors in Makurdi Local Government Area of the State. Using stratified random sampling technique, 25 students were each selected from part II, III while 5 instructors were also drawn from each of the two Science and Technical Colleges located in Makurdi Local Government Area of the State. A total of one hundred (100) electrical students and ten (10) instructors therefore formed the sample size for the study. The instrument used for data collection was a 15 item structured questionnaire developed by the researchers based on a 4 point rating scale of Strongly Agree, Agree, Disagree and Strongly Disagree respectively. The items were developed based on information obtained from literature review as contained in the three research questions. Data collected was analyzed using mean and standard deviation to answer the three research questions. A mean rating of 2.5 and above was taken as agreed, while items with a mean value of less than 2.5 were considered as being disagreed upon.

RESULTS

Question 1: To what extent are solar lighting system facilities available at homes or hostels of Science and Technical College Students?

Table 1: Availability of solar lighting system facilities

S/N	Item Description	\bar{x}	STD	Decision
1.	Our school has solar facilities in classes / laboratories	1.95	0.49	Disagree
2.	The library / hostel has a solar lighting system	1.94	0.61	Disagree
3.	Our houses have solar lighting lamps fixed	3.20	0.82	Agreed
4.	In our houses, we have small table solar lamps that we use	2.75	0.77	Agreed
5.	The electronic gadgets in our house are powered by solar energy.	2.63	0.83	Agreed
Cluster mean and Standard Deviation		2.50	0.71	Agreed

Result in table 1 show that there are no solar lighting facilities in the class rooms, libraries, laboratories and hostels of the Science and Technical Colleges in Makurdi Local Government Area of Benue State. Respondents however, agreed that their houses have solar lighting lamps fixed in, have small table solar lamps that they use when there is power failure from the main and electronic gadgets in their houses are powered by solar energy.

Question 2: What is the level of utilization of solar lighting facilities by students during night studies in their homes or hostels of students?

Table 2: Level of utilization of solar lighting facilities

S/N	Item Description	\bar{x}	STD	Decision
6.	We have solar generators installed that power our classes through the night	1.63	0.56	Disagreed
7.	When there is power failure, we use solar power lamps in our hostels	1.72	0.72	Disagreed
8.	The lighting systems used in our house is solar powered and there is light always	3.08	0.65	Agreed
9.	Some students have small solar lamps which they personally use in event of power failure	3.47	0.50	Agreed
10.	There are no solar lighting lamps that power the school workshops and laboratories	2.94	0.63	Agreed
Cluster mean and Standard Deviation		2.56	0.61	Agreed

Table 2 show that there are no solar generators installed in the classes of Science and Technical Colleges that power them throughout the night. Result also indicates that there are no solar powered lamps in hostels and school workshops to serve as standby source in case of power failure. Respondents however agreed that they use solar lamps in their homes during public power failure.

Question 3: To what extent does the use of solar lighting system affect academic performance of students of Science and Technical Colleges in Makurdi Local Government Area of Benue State?

Table 3: Solar lighting system and its effects on academic performance

S/N	Item Description	\bar{x}	STD	Decision
11.	Solar lighting improve classroom conditions and students participation in class work	3.08	0.69	Agreed
12.	It increases students alertness and good responses in classroom	3.21	0.80	Agreed
13.	Adequate solar motivates teachers to prepare their lesson plans, and mark scripts in the night.	3.20	0.92	Agreed
14.	Inadequate solar lighting increases fatigue and eyestrain	2.86	0.87	Agreed
15	Solar lighting facilities enable students to complete their assignment before going to bed	2.70	0.97	Agreed
Cluster mean and Standard Deviation		3.01	0.85	Agreed

Table 3 show that, respondents rated all the five items provided in the table greater than 2.5 indicating that they accepted all the items. Respondents agreed that solar lighting improve classroom conditions and students participation in class work, it increases students alertness and good responses in classroom, adequate solar light motivates teachers to prepare their lesson plans, and mark scripts in the night, while the solar lighting system enable students to complete their assignment before going to bed.

DISCUSSION OF FINDINGS

Findings on the availability of solar lighting facilities indicates that schools hostels, libraries and classes of these technical colleges have no solar lighting facilities to enhance teaching / learning. Most students however use solar power lamps and in their homes during learning. This finding is consistent with Achilla (2014) who noted that most schools in Africa operate without solar lighting facilities. On the level of utilization of solar lighting facilities, findings show that solar lighting facilities are rarely utilized in the classroom or hostels of technical colleges in Makurdi local government Area but rather such facilities are found in the students' homes. This finding agree with Agoramorthy and Hsul (2009) who found that the solar lighting technology is widely accepted in homes rather than churches and schools buildings where they are supposed to be more valuable.

Finding on the effect of solar lighting system on the academic performance of learners indicates that solar lighting system has impact on the academic performance of learners. All the items presented on the effect of solar lighting system on academic performance of technical college students were accepted. This finding is also consistent with Lid and Lam (2013) who found that the performance of students in their academic work increases with improved power system using solar powered classrooms.

CONCLUSION

From the findings of the study, it is clear that there is no solar power system installed in any of the technical college classroom, laboratories, workshops, hostel or library in Makurdi Local Government Area of Benue state. However, most of the respondents agreed that they have solar generators or solar lamps in their homes which are used for illumination and to power their electrical / electronic gadgets as a result. They confirm that with solar power system in their homes, they always have steady light which enable them to carry out their academic activities before going to bed. Furthermore, respondents agreed that the use of solar lighting increase students' participation in the class activity, improves the performance of the students in the class, reduce absenteeism and enable teachers to plan their lessons and mark scripts.

RECOMMENDATION

Based on the findings, the following recommendations are made:

1. Government should assist the two technical colleges with funds to provide solar lighting system in their hostels, classrooms, workshops, laboratories and libraries.
2. Stakeholders in education should through Parents Teachers' Association or on individual basis provide solar lighting facilities to Science and Technical College libraries, hostels and classrooms to solve the problem of incessant power failure in schools during academic work.
3. Education planners and architects should incorporate solar lighting systems as a basic requirement in building and equipping educational institutions. This will take care of power failure due to the use of generators that utilizes fossil fuel with their attendant side effects like respiratory problems.

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