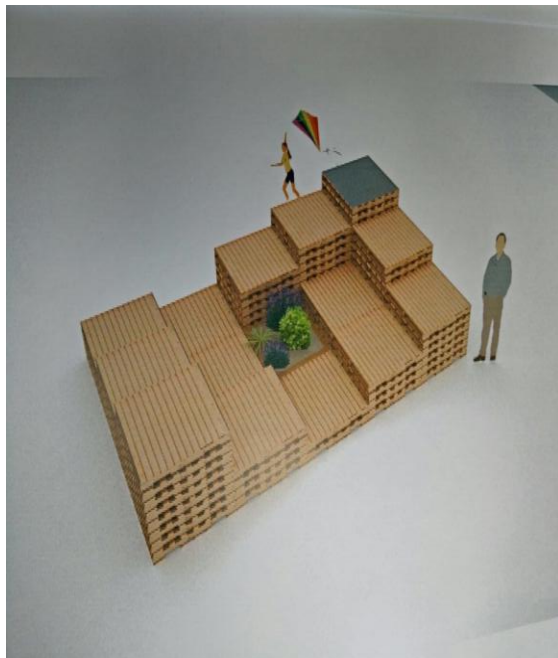


Green classroom/ Solar urban design



Al-Hekma International School

8th Grade/Middle School

Ms.Rasha Al-Najjar

March 2017



CONTENTS

Coverpage	1
Contents.....	2
Abstract.....	3
Variables.....	3
Hypothesis.....	4
Background Research.....	4
Material List	5
Procedure.....	6
Data Collected from School	7
Results and Analysis-----	7,8
Conclusion and Recommendations-----	9
Acknowledgements	9



Green Classrooms /Solar Urban Design

Abstract

The Outdoor Green Classroom was constructed to facilitate education and study habits in a pleasant outdoor environment. It highlights greater self-esteem, cooperation, conflict resolution, leadership, relationship with peers, problem solving, motivation to learn, and behavior in class by students involved in outdoor education. It also helps in building global responsible sustainable citizens that care about their environment. One of our goals is to support our country's (Bahrain) sustainable vision 2030. The green classroom idea also links to two of the UN sustainable development goals:

1-SDG 11 "Sustainable Cities And Communities": Make cities and human settlements inclusive, safe, resilient and sustainable.

2-SDG 12 " Ensure sustainable consumption and production patterns ": Sustainable consumption and production is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services.

Our hypothesis was that reducing electricity use and focusing on solar power will surely affect the carbon foot print. The experimental results supported our hypothesis by showing that the school electricity bills were reduced. The experiment results also reflected that student's academic achievement were better.

Questions

What benefits will a green outdoor class have on students and on our community?

How a green classroom would help in cutting down carbon footprint?

Can we spread this idea among public and private schools in Bahrain?

Variables

Independent Variable: Time, how many tablets need to be charged and for how long.

Dependent Variable: Solar panel/Voltage.



Table 1

Variables

<u>Experimental Group</u>	<u>Controlled Variable for Each Group</u>
Conducting an outdoor classroom (8A/24 students)	Same number of students of the same class was conducted in a normal indoor classroom using electricity power.
Charging 6 tablets using alternative energy/solar power.	Same tablets were used and charged.

Hypothesis

As we introduce the green outdoor solar design classroom to our school, both the carbon footprint and the school electricity bill will be reduced. The students will also perform better when attending classes outdoors.

Background Research

Our research was divided to several parts.

The Globe team students worked on the following:

1-Researching for sponsor policies/and searching for sponsors in our community.

(For the solar panel, 3D design and the wood pallets).

2- Researching for the best solar panels that match our criteria/searching for places that sell Solar panels in Bahrain.

3-Researching for wood pallets (recycled).

4-Researching for fundraising ideas to hold in school

(To purchase the paint and cushions).

5- Research about the relation between electricity consumption and carbon foot print.

Our students worked very hard on their research and the results were magnificent.



We were lucky to find **Al Alawi manufacturer** who provided us with recycled wood pallets for free, and they were in a very good condition.

Regarding the design, we collected all our sketches and after a long research we were introduced to find Ms. Maysam from **1-1 Designs** who provided us with the final D3 design (free of charge).

The Solar panel was a big challenge; very few places in Bahrain purchase or sell solar panels. If they do they are overpriced! We looked around and asked here and there until we were introduced to **IG Electronic**. A small shop that has different sizes of solar panels and they were very generous and gave us a good discount for a panel that's supplies 432 Watt/day (the size we requested after calculating the power needed to charge 6 school tablets).

We organized 3 fundraising activities (Juice sale, pizza day and doughnut day), proceeds collected were used to purchase the solar panel.

After all the research, data collection, and activities we started the actual planning.

The plan is to assign different outdoor classes / week.

When each class leaves their classroom for 50 minutes and stop using the;

1-smart board

2-lights

3-projector

4-computer

5-tablets

6-Acs

We have conducted our research with the help of the operational manager, electricians and workers.

The plan is to measure the consumption per week, then per month till the end of this academic year 2016-2017.

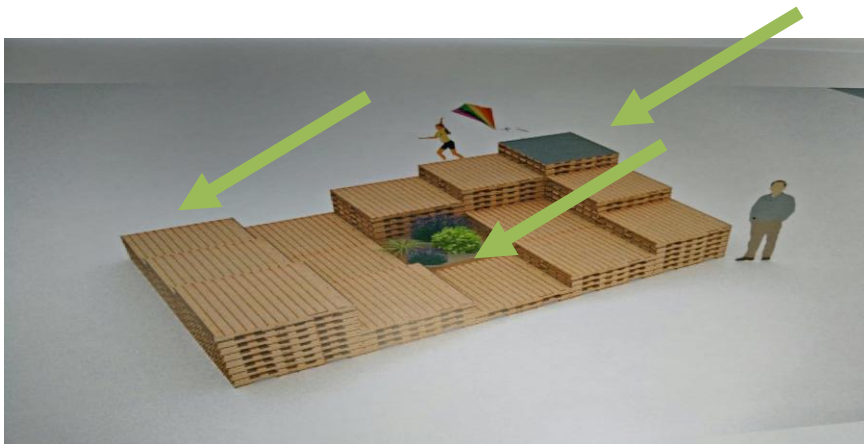
Outcomes will be compared to the previous consumption and data will be analyzed.

Materials List

- School tablets
- Tablet batteries
- Wood pallets (100)
- Paints
- Solar panel (12 V, 50 W)
- SMF rechargeable battery (12 V,40A)
- Solar Charge controller (12 V,10A)
- 6 Dc Power Jack
- Wires and clips
- Cushions

Procedure:

1. Collect data from school (number of electronic items on every floor).
2. Measure each tablet battery voltage by using the voltmeter.
3. Fix all the wood pallets according to the D3 design provided by 101 designs.
4. Plant in the middle part of the urban design.
5. Paint the pallets.
6. Try charging the tablets using the solar panel (different classes were invited for the outdoor class trial experience).





Data collected from school:

Number of electric items in each floor

electric items	ground floor	first floor	second floor	third floor	fourth floor	total
Lights 2 feet 4 tubes	36	0	0	1	167	203
AC	28	17	22	22	29	118
Fan	39	10	13	15	0	87
water cooler	3	2	2	2	1	10
washing mashine	2	0	0	0	0	2
lights 4 feet 2 tubes	88	100	84	91	0	363
lights led	45	3	0	15	0	60

Results and Analysis

It was noticeable that when comparing the academic achievements of students (Experimental group , that attended their lessons in an outdoors and used alternative energy/solar panels) to students who attended their lessons in an indoor classroom using full electrical power (controlled group). The academic achievement results were higher in the Green outdoor class. Table 2 displays the result.

Table 2

Subject	Indoor classroom Average of Achievement	Outdoor Green Classroom Average of Achievement
Mathematics	70%	85%
Science	75%	90%
English	85%	90%
Social Studies	65%	80%
Arabic Language	80%	95%



School Electricity bills (reflecting the reduction in the total amount):

Kingdom of Bahrain مملكة البحرين
Electricity and Water Authority هيئة الكهرباء و الماء
Customer Services Directorate إدارة خدمات المشتركين
 P.O.Box: 2 ص.ب: 2
 Website: www.ewa.bh

BILL FOR THE MONTH OF : Oct 2016
 DATE OF ISSUE : 18/10/2016
 DUE DATE : 08/11/2016

18/10/2016 Alhekma International School
 P.O.BOX 26489
 ADILYA BAHRAIN

Customer Account No.
8739007

OVERDUE BILL

BILL SUMMARY	Amount
Previous Billing	11735.732
Other Transactions	0.000
Payments	0.000
Arrears	11735.732
Current Month Bill Charges	3131.540
Total Amount Due	14867.272



Kingdom of Bahrain مملكة البحرين
Electricity and Water Authority هيئة الكهرباء و الماء
Customer Services Directorate إدارة خدمات المشتركين
 P.O.Box: 2 ص.ب: 2
 Website: www.ewa.bh

BILL FOR THE MONTH OF : Nov 2016
 DATE OF ISSUE : 21/11/2016
 DUE DATE : 12/12/2016

21/11/2016 Alhekma International School
 P.O.BOX 26489
 ADILYA BAHRAIN

Customer Account No.
8739007

OVERDUE BILL

BILL SUMMARY	Amount
Previous Billing	14867.272
Other Transactions	0.000
Payments	-4342.758
Arrears	10524.514
Current Month Bill Charges	3629.190
Total Amount Due	14153.704





مركز العلوم والبيئة



Kingdom of Bahrain
Electricity and Water Authority
Customer Services Directorate
P.O.Box: 2
Website: www.ewa.bh

مملكة البحرين
هيئة الكهرباء و الماء
إدارة خدمات المشتركين
ص.ب: ٢



BILL FOR THE MONTH OF : Dec 2016
DATE OF ISSUE : 16/12/2016
DUE DATE : 07/01/2017

16/12/2016
Alhekma International School
P.O.BOX 26489
ADILYA BAHRAIN

Customer Account No.
8739007

OVERDUE BILL

BILL SUMMARY	Amount
Previous Billing	14153.704
Other Transactions	0.000
Payments	-4500.000
Arrears	9653.704
Current Month Bill Charges	1955.310
Total Amount Due	11609.014

Conclusions and Recommendations

Our hypothesis was that reducing electricity consumption in classrooms will aid in decreasing the carbon foot print and in spreading sustainable education among AHIS students. It will also aid in Bahrain's sustainable vision 2030 and the supports the UN SDGs (sustainable development goals).

The assessment results and feedback collected from students in regards of the outdoor green classrooms were very positive and as expected.

Interesting future researches:

- 1- Finding ways to utilize the solar urban design during cold rainy days.
- 2- How to apply the green classroom concept in other schools around Bahrain.

Acknowledgements

We would like to thank all the sponsors that help us turn our dream plan into reality.

-1-1 Designs (Mr.Maysam) <http://www.1-1architecture.com/home>

-Al-Alawi manufacturer

-IG Electronics <http://www.igelectronics.com/>

-Al-Hekma International school staff and students <https://www.alhekma.com/>