Health Issues among the Visually Impaired Students due to the Lighting System in their Institutions: A Comparative Study (Heritage and Newly Constructed Buildings)

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Abstract—*A study was undertaken to find out the health issues among the visually impaired students due to the lighting system in their institutions.*
For this study, four institutions of University of Delhi were selected. There are four institutions, two institutions having old construction which are heritage and two other institutions are newly constructed. Forty respondents, which are selected from the four colleges, formed a part of the sample to know their problems such as flickering, glare, postural problems, and headache and eye strain etc. All selected respondents are visually impaired. Purposive random sampling was used. The tools used for data collection were observation and questionnaire. A checklist was made to compare the lighting systems of all four institutions. Alighting software which name is Dialux was used to design the appropriate class room with the appropriate lighting.

Keywords: *Light, IL luminance, glare, flicker, energy efficiency.*

1. INTRODUCTION

Light is vital for any work as we see and operate in the presence of light. The quality and quantity of light is imperative as it determines reading efficiency and concentration. Visibility is an important aspect of reading; even though we may be able to read in less light (as low as 10lux) but our proficiency and alertness are affected. Students working with visual display units (VDU's) are dissatisfied with the lighting environment in the institutions. Those affected often convey that the lighting was either too bright causing glare, distraction and subsequent eyestrain and headache.

Sustainability designed buildings aim to decrease their impact on the environment through energy and reduce efficient technologies including lighting.

The intuitions have gone through a series of evaluation and expansion over the recent decades in whole world and especially in India because reading is a generic activity in a civilized society.

The study will help to find out the health issues among the visually impaired students due to the lighting system in their institutions as well as to find out the lighting practices adopted by the institutions members.

2. OBJECTIVE OF THE STUDY

In this paper efforts are made to full fill the following objectives:

1. To find out the health issues among the visually impaired students due to the lighting system in their institutions.

2. To compare the lighting practices adopted in the newly constructed and old constructed (heritage) institutions.

3. RESEARCH METHODOLOGY

The study was carried out in various institutions of University of Delhi. After conducting preliminary survey based on easy accessibility the four institutions were finalized, two institutions having old construction which are heritage and two other institutions are newly constructed.

Forty respondents, which are selected from the four colleges, formed a part of the sample to know their problems such as flickering, glare, postural problems, and headache and eye strain etc. All selected respondents are visually impaired.

The study is exploratory in nature, purposive sampling technique was used to select the institutions and random sampling technique was used to select the respondents for the study. The tools used for data collection were observation and questionnaire. A flux meter were also used to check the appropriate day lighting in various part of the institutions such as class rooms, library, corridor, seminar cum demonstration

room and laboratories etc. A checklist was made to compare the lighting systems of all four institutions.

4.   RESULTS AND DISCUSSION

The present study entitled "Health Issues among the Visually Impaired Students due to the Lighting System in their Institutions: A Comparative Study (Heritage and Newly Constructed Buildings)" focus on the health issues related to the visually impaired students.

The data has been analyzed under the following sections:

**1.   Health issues among the visually impaired students:**
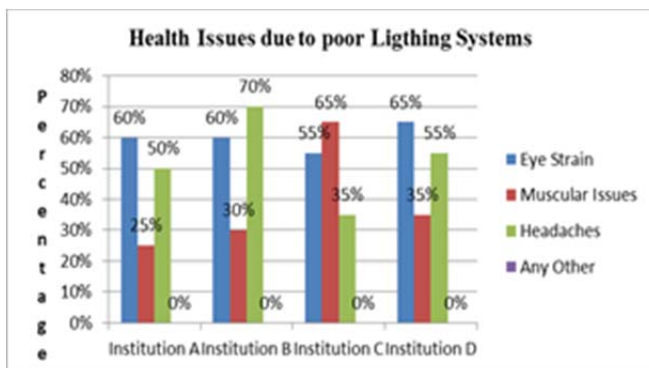
Graph 1: Health issues due to poor Lighting Systems

Thus, when we look at the data represented in the graph 1 of the four different colleges have some issues of due to poor lightings were indicated i.e. headache, muscular and eye strain.

Thus, when we look at the graph 2 it indicates that the mostly respondents had the clear vision in all institutions and the vision clarity were slightly vary among all the four institutions. Only fifteen to twenty five percent students reported that they had no clear vision in their institutions while 75 to 80 percent students reported that they had clear vision in their institutions.
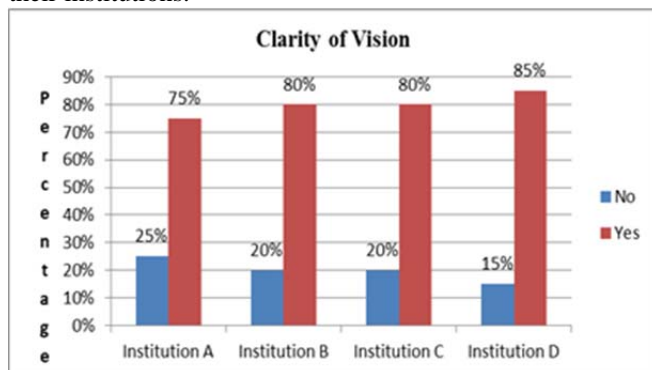

Graph 2: Clarity of Vision
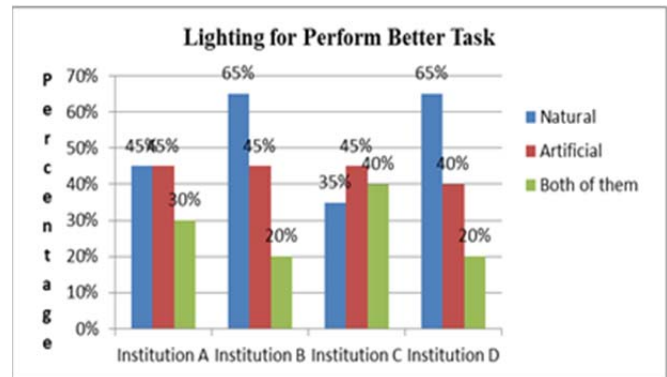

Graph 3: Lighting for perform better task

Thus, graph 3 shows that the mostly respondents had appropriate lighting for perform better task who belongs Institution B and Institution D and the respondents of Institution A and C comparatively had insufficient lighting for performing better task. The only reason behind this is only the difference of construction in buildings. Institution B and Institution D have heritage structure while Institution A and Institution C have newly constructed buildings and Institution B & D have appropriate natural lighting with the combination of artificial lighting while Institution A & C have insufficient natural lighting. So it's finding that the students of the Institution A & C had difficulty to perform better task while the students of Institution B and D had no issues to perform any task in their institution due to the poor lighting.
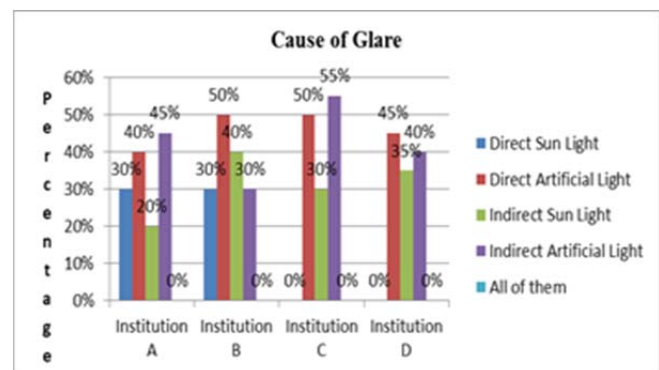
Graph 4: Cause of Glare

Thus, when we look at the data represented in the graph 4 of the four different colleges that mostly respondents had glare issues who belongs Institution A and Institution C and the respondents of Institution B and D comparatively had no issues. The only reason behind this is only the difference of construction in buildings. Institution B and Institution C have heritage structure while Institution A and Institution D have newly constructed buildings and Institution B & D have large windows with the deepest external shading structure while Institution A & C have small windows with the small vertical

shading structure So it's found that the structure of the windows in Institution A & C cannot prevent of the glare which enter the classrooms with the daylight.
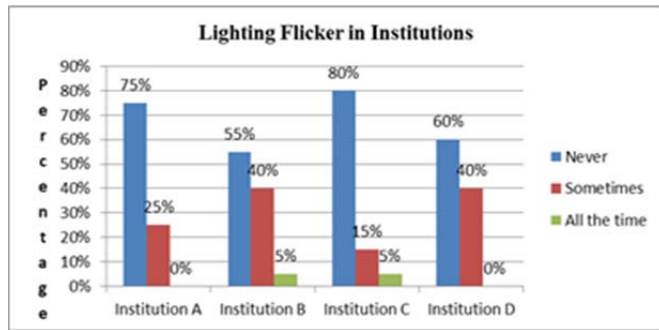
Graph 5: Lighting Flicker in Institutions

Thus, when we look at the data represented in the graph of the four different colleges that mostly respondents had flickering issues who belongs Institution B and Institution D and the respondents of Institution A and C comparatively had no issues because both institutions have old lighting fixture and only 45 per cent students were reported that they face the problem of flickering in their class room of the Institution B and Institution D while it was noticeable by the researcher also that the maximum flickering were found in the institution B and institution D. Institution A and Institution C have more and new energy efficient lighting as compare to the Institution B and Institution D. So, flicker problem in those institutions have not been found.

Improved lighting design of the class room:

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04 / 09 / 2015
Operator
Telephone
Fax
E-Mail

Height of Room: 9.000 ft.,
Mounting Height: 7.688 ft.,
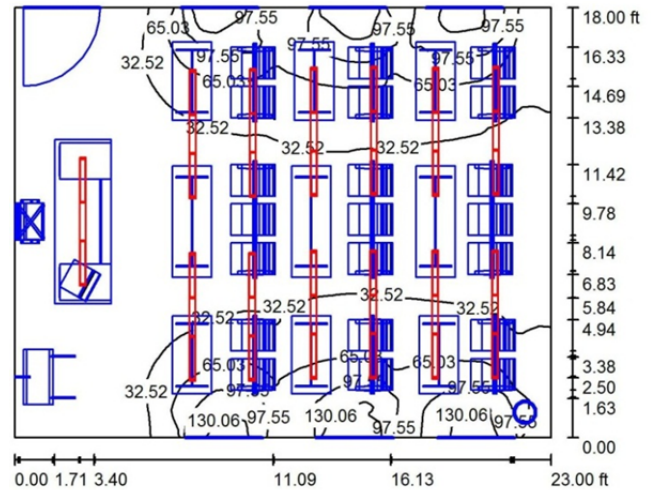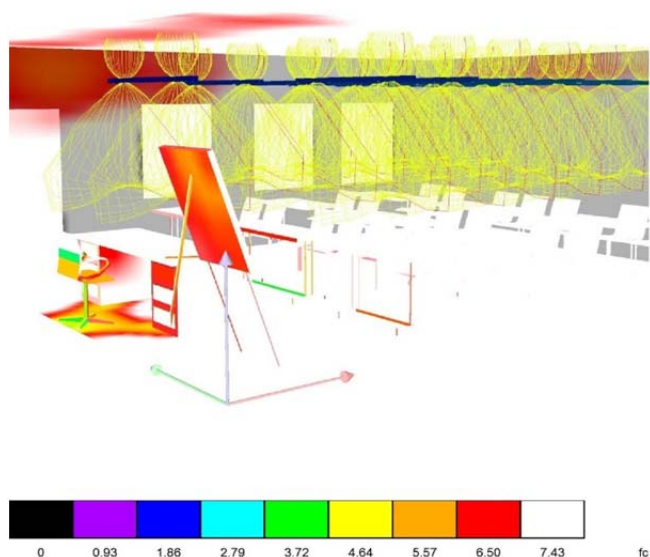Light loss factor: 0.80
Values in Foot-candles, Scale 1:71

Fig. 1: Summary of lighting distribution in the class room

Table 1: Photometric result of lighting scene in classroom

Total Luminous Flux:	41910 lm			
Total Load:	**702.0 W**			
Light loss factor:	**0.80**			
Boundary Zone:	**0.000 ft.**			

	Average illuminances [fc]			Reflection factor [%]	Average luminance [cd/m²]
Surface	**Direct**	**Indirect**	**Total**		
Work plane	36	6.32	43	/	/
Floor	17	5.79	23	52	40
Ceiling	0.00	8.93	8.93	52	16
Wall 1	3.30	8.39	12	75	30
Wall 2	12	7.86	20	75	50
Wall 3	3.26	8.45	12	75	30
Wall 4	3.83	6.11	9.94	75	26

Fig. 2: 3D rendering of lighting in class room

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Fig. 3: False color rendering of lighting in class room

The height of the class room was 9ft and the mounting height was 7.688 ft. Lighting loss factor is only 0.80 and the value in foot candles, scale is 1:71.

Table 1 depicted that the Photometric result of lighting scene in classroom which shows that the amount of the total direct and indirect lighting on the work plan, floor, ceiling and all walls are appropriate to perform the better task as well as the clarity of vision.

Fig. 2 and 3 shows the 3D and the false colour rendering of the lighting in the class room and it was clearly indicated that the combination of natural day lighting and the artificial lightings were sufficient to perform the task.

Table 2: Clearly indicated that:

i. The CFL and LED were found in all the four institutions while T3 was only found in institution B.

ii. Institution B was the heritage building still T3 lights and electronic ballast for fluorescent tubes were found in the institution B.

iii. Halogen lightings, solar power system and high intensity discharge lamps were not found in any institution.

iv. Reflectors for Fluorescent Light Fixtures were found in all four institutions.

v. Optimum usage of day light was sufficient in institution B and D which are heritage buildings while the usage of daylight in institution D was sufficient and institution A had the insufficient usage of day light.

Table.2: Checklist for the comparison of lighting in all four institutions

S. No.		Institution A	Institution B	Institution C	Institution D
1.	**LIGHTING FIXTURES**				
	CFL	Yes	Yes	Yes	Yes
	LED	Yes	Yes	Yes	Yes
	T3	No	Yes	No	No
	T5	No	No	No	No
	T8	No	No	No	No
	Halogen Lights	No	No	No	No
	Solar Power Lights	No	No	No	No
	High Intensity Discharge Lamps (HID)	No	No	No	No
	➢ Metal Halide	No	No	No	No
	➢ High Pressure Sodium	No	No	No	No
	➢ Low Pressure Sodium	No	No	No	No
	➢ Mercury Vapour	No	No	No	No
	Electronic Ballast for Fluorescent Tubes	No	Yes	No	No
	Reflectors for Fluorescent Light Fixtures	Yes	Yes	Yes	Yes
2.	BUILDING ENVELOPE				
A.	Solar Orientation	No	No	No	No
B.	Optimum usage of daylight	Not Sufficient	Sufficient	present	Sufficient
C.	Windows	Present	Present	Present	Present
D.	Corridor	Present	Present	Present	Present
3.	LIGHTING CONTROLS				
	Electronic dimmers for lighting	No	No	No	No
	Occupancy Sensors	No	No	No	No
	Timers to turn off lights	No	No	No	No

5. CONCLUSION

1. It was found that the health issues were majorly reported by the students of institution A & C (which are newly

constructed buildings) as compare to the students which are studying in the institution B &D because these institutions had old construction these were the heritage buildings.

2. Heritage institutional buildings (B and D) have the large windows with the deepest external shading device. The sunlight doesn't directly go into the class room. So, it was also preventing the glare. (See fig. 4)

Fig. 4: Window with the deepest external shading device

3. On the other hand, large windows with the deepest external shading device were absent in the newly constructed institutional building (A and C). The sunlight directly goes into the class room. So, glare was commonly found in the newly constructed buildings. (See fig. 5)

Fig. 5: Small window with the small external shading device

4. The lighting system and the structure of the buildings play an important role to overcome the lighting related health issues.

5. Sustainable lightings helps to reduce the electricity consumption but it's also true that without the appropriate installation of these lighting produce the various types of health issues such as glare, headache and eye strain.

6. Combinations of appropriate day lighting and sustainable lighting flux are necessary to reduce the health issues.

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