

# Impact of Inadequate Lighting in Schools on Student Vision

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**Abstract:** Artificial light or artificial lighting compensates for the lack of natural light in its presence or absence, so in both cases it is important to respect the norm in force so that a human being finding in one of these two figures can not end up in visual discomfort. There is a natural deterioration of the visual functions and an artificial deterioration, the two cases of the fatigues lead to the modification of the structure and the functioning of the eye. For a deficit lighting in a classroom, the solution is that of adding extra lighting while going through a resizing of the lighting circuit and the choice of lamps to use, but for school building projects future, it is important that they be erected while respecting construction and lighting standards.

**Keywords:** Impact, Unsuitable, Lighting

## 1. Introduction

Visual fatigue is a physiological consequence of activities that intensively and persistently engage visual functions; it appears more frequently when the visual system has to work at the limits of its capabilities and / or for a long time.

In addition, the stress factors resulting from ergonomic inadequacies (poor lighting, inadequate layout of the workstation, etc.) require additional effort and contribute to visual overload; this is how we focused on inadequate lighting by making the evaluation (measurement) of the electric illuminance in one of the schools using a luxmeter and comparing the results to the recommended (standardized) values, these lead us to require extra lighting (resizing the lighting circuits) to avoid visual overload.

## 2. Presentation of Samples and Results of Research

We collected data from ten primary and secondary schools in Likasi, namely:

- MUSOFI High School
- NYELE High School
- Technical Institute LUMIERE DU CHRIST
- KALUNGA Institute 2
- Institute of Elites II
- Institute of Elites I
- MUDILO Institute
- St. Therese Institute
- Industrial Technical Institute SNCC
- School Complex la BORNE

In each of the ten schools that made up our sample, we measured the lighting in five classrooms and the data are presented as follows:

### 1) MUSOFI High School

**Table 1:** Illuminance at Musofi High School

Room	Illumination [Lx]	Medium illuminance ( $E_{mov}$ )
1	198,8	147,5
2	115	
3	134,6	
4	155,6	
5	136,2	

### 2) Technical Institute LUMIERE DU CHRIST

**Table 2:** Illuminance at LUMIERE DU CHRIST Institute

Room	Illumination [Lx]	Medium illuminance ( $E_{mov}$ )
1	27,5	56,28
2	12,32	
3	74	
4	104,7	
5	62,9	

### 3) St. Therese Institute

**Table 3:** Illuminance at SAINTE THERESE Institute

Room	Illumination [Lx]	Medium illuminance ( $E_{mov}$ )
1	374	366,2
2	533	
3	524	
4	163	
5	237	

### 4) Institute of Elites I

**Table 4:** Illuminance at LES ELITES I High School

Room	Illumination [Lx]	Medium illuminance ( $E_{mov}$ )
1	164	140,78
2	113	
3	96	
4	196,8	
5	134,1	

### 5) Institute of Elites II

**Table 5:** Illuminance measured at DES ELITES II Institute

Room	Illumination [Lx]	Medium illuminance ( $E_{mov}$ )
1	334	360,88
2	401,2	
3	290	
4	289,4	
5	490	

**6) School Complex la BORNE**

**Table 6:** Illuminance measured at la BORNE High School

Room	Illumination [Lx]	Medium illuminance ( $E_{moy}$ )
1	113	92,26
2	72	
3	80	
4	94	
5	102,3	

**7) MUDILO Institute**

**Table 7:** Illuminance measured at MUDILO Institute

Room	Illumination [Lx]	Medium illuminance ( $E_{moy}$ )
1	100,2	152,05
2	94,16	
3	270,4	
4	156,2	
5	139,3	

**8) Industrial Technical Institute SNCC**

**Table 8:** Illuminance measured at the Industrial Technical Institute SNCC

Room	Illumination [Lx]	Medium illuminance ( $E_{moy}$ )
1	392	353,6
2	380	
3	361	
4	370	
5	266	

**9) KALUNGA Institute 2**

**Table 9:** Illuminance measured at KALUNGA 2 Institute

Room	Illumination [Lx]	Medium illuminance ( $E_{moy}$ )
1	36,9	64,42
2	104	
3	91	
4	40	
5	50,2	

**10) Technical High School NYELE**

**Table 10:** Illuminance measured at Technical High School NYELE

Room	Illumination [Lx]	Medium illuminance ( $E_{moy}$ )
1	120	131,3
2	110	
3	114,6	
4	102,3	
5	209,6	

**11) Deficit of illumination to be compensated by school**

**Table 11:** Loss of light

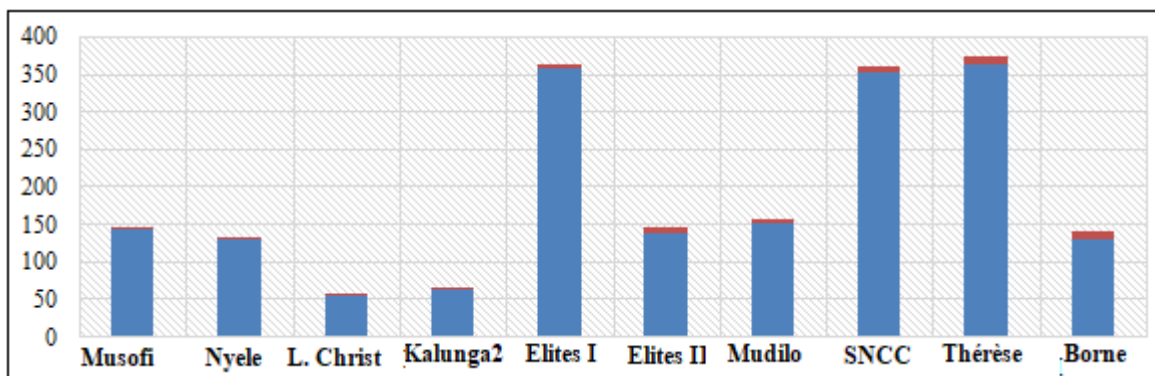
School	Emoy [Lux]	Recommended lighting [Lux]	Deficit irradiance [Lux]
Lycée MUSOFI	147	500	353
C.S.T NYELE	131,6	500	368,4
I.T LUMIERE DU CHRIST	56,28	500	443,72
I.SAINTE THERESE	366,2	500	133,8
C.S LES ELITES I	140,78	500	359,22
C.S DES ELITES II	360,88	500	139,12
C.S LA BORNE	92,26	500	407,74
I.MUDILO	152,05	500	347,95
I.T.I SNCC	353,6	500	146,4
I.KALUNGA 2	64,42	500	435,58

**N.B:** All these illuminations were measured under a natural illumination of 270.01 Lux using the luxmeter below.



Digital lux meter used for measurements

**12) Histogram of Average Éclairéments by School**



**Figure 1:** Average illuminations by schools

### 3. Interpretation of Results

The results thus presented after measuring the illumination with a luxmeter shows a very great difference between the illumination recommended in the standard NF X 35 - 103 revised which is 500 Lux so that there is visual comfort for a pupil evolving in this environment.

During our investigations (data collection), we were struck by two aspects namely:

- 1) Failure to comply with the construction standard for school buildings
- 2) Failure to respect the sizing rules of artificial lighting.

The school building standard stipulates that school buildings must be arranged in such a way that the gable walls are oriented from east to west to allow uniform distribution and maximum reception of natural light in a room of class. The sizing rules of artificial lighting make it possible to determine the number of light points, their locations and especially to choose the lamps that can produce adequate lighting leading to visual comfort.

The two pinned aspects led us to categorize the ten schools chosen into two groups:

#### 1<sup>st</sup> Group

- 1) MUSOFI High School
- 2) NYELE High School
- 3) la BORNE High School
- 4) Elites I High School
- 5) Elites II High School
- 6) SNCC Technical Institute
- 7) St. Therese
- 8) MUDILO Institute

In the first group, the observation is that:

- Illumination is not uniform in classrooms
- The number of light points is insignificant
- The chosen lamps are incandescent
- Three quarters of rooms meet the construction standards set out above

#### 2<sup>nd</sup> group

- 1) KALUNGA 2 Institute
- 2) Technical Institute LUMIERE DU CHRIST

The second group includes two schools operating in residential houses, that is to say, not respecting any building standards for school buildings and a largely insufficient lighting.

### 4. Conclusion and Recommendations

According to Pheasant [4], the design of the visual work environment and visual tasks is important because the visual elements of the task determine the posture of the head and neck; the bad visual requirements are generating visual fatigue. We recommend that schools be able to:

- Compensate natural light by integrating the deficient lighting given in Table 12 while resizing the artificial lighting and choosing the compact fluorescent lamps

following the supply of the national electricity company whose mains voltage varies between 120V and 170 volts, which leads to an incandescent lamp, to a red color radiation instead of a yellow color normally emitted by an incandescent lamp fed at 220 V, which gives a color temperature equal to 500 degrees Kelvin instead of a value between 3,000 - 4,000 Kelvin degree as recommended in a classroom;

- Respect building standards in this area so that natural light is received in the classroom as much as possible so that the amount of artificial light that will have to compensate for natural light is low, thus imposing a low consumption of electrical energy by the students. schools.

### References

- [1] Association française de l'éclairage : les radiations optiques en médecine, Société d'éditions Lux, 1993
- [2] Eclairage artificiel : Roger Cierges, 2013
- [3] Eclairage et Vision : Robert FLURU
- [4] PHEASANT, S. : Ergonomics, Work and health London, Macmillan, 1991
- [5] OWENS D.A, WOLF-KELLY, K., Near work, Visual fatigue and radiations of oculomotor tonus, Investigate Ophthalmology and visual Science, 1987, 28, 743 – 749
- [6] SALSI S., BARVIER A., Dangers présentés par les lampeshalogènes I.N.R.S, 1989, 137, Sécurité, 1993, 1 – 27