

# Comparison of the Lighting Environment in Study Rooms for Juveniles between the City and the Country

Hyun-Ji Kim\* · Gyeong-Seon Jeon · Ok-Hee An\*\*

## Abstract

The research aims at providing data needed for planning the lighting of a study room by comparing the lighting environments of study rooms for urban and rural juveniles. The subject of the research was 300 students in middle schools in Daegu and Cheongdo-gun, Gyeongsangbuk-do (Daegu 150 houses and Cheongdo 150 houses), and their study rooms were examined.

The following is the result of the research.

First, rural students stayed more time in their study room than urban students. The task that rural students (studying) and urban students (studying and using computer) all did in their study room was mainly visual work.

Second, although the sizes of rural study rooms were bigger than those of urban study rooms, urban study rooms had more light sources than rural study rooms. In the rate that of having a task lighting, the city(87.1[%]) was higher than the country (45.7[%]). However, the rate of using a task lighting was lot high in both the city and the country.

Third, the result that compared the average values of illuminations on desk planes was that the average value of the city was 3.4 times higher than that of the country. Also, the average value of the country did not meet the standard illumination of Korean industrial standards (KS). In particular, it did not reach the lowest standard. The result is related with that only 52[%] of students who had a task lighting used it.

Finally, the satisfaction of lighting environment in the city was generally higher than the country. Especially, although the country had a low illumination, the user showed a high satisfaction. It indicates that people living in the country need to understand about the needs of illumination.

Key Words : Study Rooms For Juveniles, Visual Work, Desk Plane, Illumination, Task Lighting

## 1. Introduction

The lighting environment of study rooms for juveniles can be a direct reason for the drop of eyesight if a reasonable plan was not carried out for the rooms. Also, since study rooms are used for studying rather than for taking a rest, the

---

\* Main author : Yeungnam University  
\*\* Corresponding author : Yeungnam University  
Tel : +82-53-810-2865, Fax : +82-53-810-4667  
E-mail : kim9556@yumail.ac.kr  
Date of submit : 2009. 3. 5  
First assessment : 2009. 3. 16  
Completion of assessment : 2009. 4. 15

lighting of study rooms are divided into the seeing lighting, and above all, brightness should be secured in terms of the amount of a lighting.

However, the country is mostly composed of single-family houses, and the brightness of most of their study rooms is not secured. When comparing lighting methods appropriated for study rooms between the city and the country, there are a big difference in the use and environment of study rooms. Thus, the research tries to provide fundamental data to plan a reasonable lighting environment for study rooms reflected the characteristics of regions by comparing and analyzing the lighting environment of study rooms for urban and rural students.

## 2. The Process of Research

The research carried out questionnaire and survey examinations. The survey examination is presented in Table 1. Using SPSS WIN 14.0 program, an analysis using frequency, average, crosstabulation analysis, descriptive statistics, and so on was carried out.

Table 1. Experimental Conditions

Investigation	- City and the country of middle school students are studying in 300 households - Daegu metropolitan city 150 households, Cheongdo-gun 150 households
Research time	After sunset
Measuring tools	Minoita digital illuminometer T-1, Measuring tape, Laser range finder
Research topics	① Space size ② Type and number of light sources ③ The use of lighting and light distribution ④ Floor plans ⑤ Dominance color ⑥ Internal illumination(9 point measurement) and a desk lighting Measurement
Research methods	Research of visit actual survey
Investigate period	From December 2007 to March 2008

## 3. The Result and Analysis

### 3.1 General Facts of the Surveyed Subject

The general facts of the surveyed subject present in Table 2. The country has more family members and rooms than the city. While the city had the highest percentage (73.6[%]) in the case of living alone, the country had the highest percentage (48.3[%]) in the case of living two family members. It indicates that since the country had more users in a space than the city, an interest in the study rooms of the country should be needed.

Table 2. General Facts of the Surveyed Subject  
N((%))

Classificatio	Region	City	Country
	Gender	Man Woman	74 (50.3) 73 (49.7)
Age	13-16	108 (73.5)	149 (98.7)
	More than 17	39 (26.5)	2 ( 1.3)
	M(SD)	15.7 (1.13)	14.3 (1.08)
The number of your family members (Persons)	4 or less	112 (75.7)	62 (41.1)
	More than 5	36 (24.3)	89 (58.9)
	M(SD)	4.24 (84)	5.54 (29.1)
The number of rooms in your house	3 or less	97 (65.6)	81 (54.7)
	More than 4	51 (34.4)	67 (45.3)
	M(SD)	3.34 (60)	4.51 (3.56)
Classroom use of embroidery (Persons)	1	109 (73.6)	44 (29.1)
	2	34 (23.0)	73 (48.3)
	3	5 ( 3.4)	22 (14.6)
	More than 4	-	9 ( 6.0)
	M(SD)	1.30 (528)	2.3 (2.34)
Relationships with users (use two or more people)	brother, sister	34 (100)	96 (92.3)
	Other	-	8 (7.7)
Using classrooms time (Time)	2 or less	87 (59.6)	80 (56.3)
	3 - 5	48 (32.9)	38 (26.8)
	6 - 10	6 ( 4.1)	12 ( 8.5)
	More than 11	5 ( 3.4)	12 ( 8.5)
	M(SD)	3.00 (2.46)	3.48(3.40)
Principle works	Study	136 (94.4)	85 (56.7)
	Computer	5 ( 3.5)	43 (28.7)
	Sleep	3 ( 2.1)	15 (10.0)
	Other	-	7 ( 4.7)

It is thought that the reason that the country has a longer average use time than the city is because the country has more self-study types than private education. In the things that the urban students did in their study room, 'studying(94.4[%])' was the highest percentage. In the case of the rural students, 'studying (56.7[%])' ranked first, followed by 'doing computer (28.7[%])'. The result shows that there was a difference in the things that the urban and rural students did in their study rooms but that the thing that urban and rural students mainly did in their study rooms was visual work.

**Table 3. Hoped to Improve in Lighting Environment of Study Room and When Replacing a Lighting Sources**

Classification		Region		x <sup>2</sup>	N((%))
		City	Country		
Improving the classroom environment	brightness	30(20.7)	30(20.0)	36.314	***
	lighting design	17(11.7)	51(34.0)		
	lighting performance	45(31.0)	35(23.3)		
	uniformity	53(36.6)	17(11.3)		
	None	-	10( 6.7)		
	Other	-	7( 4.7)		
When replacing a light source	Whn life is finished	48(32.7)	66(43.7)	10.251	*
	When the Flicker	83(56.5)	56(37.0)		
	When the black edges on both sides	12( 8.2)	13( 8.6)		
	Periodically	4( 2.7)	9( 6.0)		
	Other	-	7( 4.7)		

Significance level \*p<.05, \*\*\*p<.001

The points that people hoped to improve in lighting environment of study rooms follows as. Table 3 shows that the urban families hoped to improve 'the uniformity of lighting' and 'the performance of lighting instrument,' and the rural people hoped to improve 'the design of lighting instrument.' The research presents a conscious-

ness difference between the city and the country, illustrating that the urban families wanted to enhance the uniformity and performance of lighting instrument from the terms of lighting quality and the rural families focused on the design of lighting instrument that exposes the outside of lighting instrument.

### 3.2 Status of the lighting environment of the surveyed subject

**Table 4. Space Sizes and Desk Height of the Surveyed Study Room**

Classification		Region		x <sup>2</sup>	N((%))
		City	Country		
Space sizes (m <sup>2</sup> )	5 or less	9( 6.0)	19(12.7)	212.115***	
	5 -10	104(69.3)	71(47.3)		
	11 - 19	34(22.7)	37(24.7)		
	More than20	3( 2.0)	23(15.3)		
	M(SD)	8.76(4.86)	11.42(9.36)		
Desk height (cm)	50 or less	3( 2.0)	8( 5.5)	80.867	***
	51 - 75	136(90.7)	90(61.2)		
	75 More than	11( 7.3)	49(33.3)		
	M(SD)	70.47(6.93)	74.98(13.46)		

Significance level \*\*\*p<.001

Table 4 shows the results that the space sizes and desk height of the surveyed study rooms were measured. The average space size of the city was bigger than that of the country. In the number of people who used a study room in the city, the case of one person using a study room was more than 70[%]. The case of more than two persons using a study room in the country was more than 70[%]. Although the country had a wider study room than the city, the country did not secure an enough space due to the more users compared with the city.

The result that measured the heights of desks in the study rooms shows that the rural students

Comparison of the Lighting Environment in Study Rooms for Juveniles between the City and the Country

used higher desks than the urban students. In particular, the case in which the heights of desks in the country were more than 75cm was 33[%] unlike that of the city. It is thought that the reason that the rural desks were higher than the urban desks is because the rural people used tables or other furniture instead of desk.

**Table 5. Status of the Lighting Environment of the Surveyed Subject**

N((%))

Classification		Region	City	Country	$\chi^2$
Method of using the lighting	Only a general lighting		33(22.0)	110(73.8)	91.266***
	Only a Local lighting(Stand)		1( 0.7)	6( 4.0)	
	General lighting - Local Lighting		116(77.3)	33(22.1)	
The number of lighting sources used in the classroom	1		21(14.4)	84(56.0)	65.730***
	2		91(62.3)	55(36.7)	
	3		34(23.3)	8( 5.3)	
	More than 4		-	3( 2.1)	
	M(SD)		2.09(6.09)	1.55(7.82)	
Light distribution way	General lighting	Direct lighting	148(98.6)	117(80.7)	27.327***
		Indirect lighting	1( 0.7)	2( 1.4)	
		Semi-direct lighting	1( 0.7)	8( 5.5)	
		General diffuse lighting	-	18(12.4)	
	task lighting	Direct lighting		114(96.6)	42(84.0)
Indirect lighting			-	5(10.0)	
Semi-direct lighting			4( 3.4)	-	
General diffuse lighting			-	3( 6.0)	

Significance level \*\*\* $p < .001$

In the case in which only a general lighting was used as a method of using the lighting of a study room, the city was 22[%] and the country was 73.8[%], which shows a big difference between the city and the country. Also, in the case in which the number of light sources in a study room was one, the city was 14.4[%] and the country was 56[%]. This case indicates that the country needs more

numbers of light sources than the city because the country has wider study rooms than the city (Table 5).

Table 6 shows the facts related with stands, which is a task lighting, on the desks in study rooms. In the number of stands put on tables in study rooms, the city presents 87.1[%] and the country presents 45.7[%], which indicates a big difference between the city and the country. The case in which families did not use a standard although they had it is high in both the city and the country.

**Table 6. Task Lighting on the Desks in Study Rooms**

N((%))

Classification		Region	City	Country	$\chi^2$
The stand holds absence	Have		128(87.1)	69(45.7)	56.085***
	Don't have		19(12.9)	81(53.6)	
If you have a stand, do you use it?	Use		67(52.7)	30(43.5)	5.964**
	Not use		61(47.3)	39(56.5)	
Does not stand to reason	Dazzling light		27(49.1)	11(34.4)	.785
	Hot temperature		28(50.9)	7(21.9)	
	There is no necessity		-	14(43.7)	
Position stands	Users of the right		52(41.3)	34(46.6)	.530
	Users of the Left		74(58.7)	39(53.4)	

Significance level \*\* $p < .01$ , \*\*\* $p < .001$

As the reasons that the urban families did not use a standard, 'hot temperature' and 'dazzling light' ranked the highest. As the reasons that the rural families did not, 'not feeling its necessity' ranked the highest, followed by 'dazzling light.' Based on the research's result, a performance improvement of lighting instrument is needed in the city and the country. In particular, it is thought that recognition for the importance of lighting largely lacks in the country.

In the question for the spot in which a stand

was put, the rate that the urban and rural families put in a right spot was about 50[%]. It is thought that people do not know well about the right spot of a stand on desk, and an education for the spot of a stand needs. That is, considering that people did not pay attention in efforts for the improvement of brightness such as exchanging lighting instrument and using a local lighting but they had a high demand in the design and performance of lighting instrument, education for practical lighting environment is needed.

### 3.3 Analysis on the measurement illumination of the surveyed subject

Table 7. Inside Illumination Average Values and Illuminations of Desk Planes

Classification		Region			X <sup>2</sup>
		City	Country	N(%)	
Inside Illumination average value ([lx])	100 or less	-	49(34.0)	105.897 ***	
	101-200	48(32.4)	73(50.7)		
	201-300	62(41.9)	18(12.5)		
	301-400	26(17.6)	3(2.1)		
	More than 401	12(8.1)	1(0.7)		
M(SD)		254.68(91.79)	131.82(70.66)		
Illuminations of desk planes ([lx])	100 or less	3(2.1)	53(36.2)	257.109 ***	
	101-200	8(5.4)	43(29.6)		
	201-300	6(4.0)	20(13.8)		
	301-500	16(11.2)	9(6.1)		
	501-1000	49(33.0)	17(11.6)		
M(SD)		864.20(505.36)	253.64(313.33)		

Significance level \*\*\*p<.001

Table 7 shows inside illumination average values and illuminations of desk planes. In the city there as no case in which the inside illumination average value was less than 100[lx]. However, the country shows 34[%] for the case. The average illumination value of the city is 254.68[lx], and that of the country is 131.82[lx], which presents that

the illumination environment of the country is very poor.

In the case in which the illumination of desk planes is less than 300[lx], the city is 11.5[%], and the country is 79.6[%], which shows a very big difference between the city and the country. In the case in which the illumination of desk planes is more than 500[lx], the city is 77.3[%] and the country is very low. The result that the average values of the illumination of desk planes were compared shows that the city is 864.20[lx] and the country is 253.64[lx], which presents that the case of the city is 3.4 times higher than the country. The reason that shows such results is because the illumination of desk planes in the city is high by using local stands but the illumination of desk planes in the country is low because they hardly held a stand or did not use it even if they held it.

A 3011 of KS suggests that an illumination needed for studying and reading in the study room of a house is 600[lx] at the minimum level, 1,000[lx] at the standard level, and 1,500[lx] at the maximum level. Also, it suggests that an illumination needed for playing is 150-200-300[lx]. These figures are illumination standards when a general lighting and local lighting are considered together.

Table 8. Rate of the Average Illuminations in the Study Rooms

Section	Reference illuminations ([lx])			Average illuminations ([lx])		Average illuminations / Reference illuminations × 100(%)					
	Mini mum	Stan dard	Maxi mum	City	Country	City			Country		
						Mini mum	Stan dard	Maxi mum	Mini mum	Stan dard	Maxi mum
General lighting	150	200	300	254.68	131.82	Satisf action	Satisf action	84.9	87.9	65.9	43.9
Local lighting (illuminations of desk planes)	600	1000	1500	864.20	253.64	Satisf action	86.4	57.6	42.3	25.4	16.9

Table 8 shows the results of the investigation on the standards of the average illuminations of the study rooms. In the case of the city, the average illumination of general lighting is 254.68[lx], which meets the lowest value and standard value of the reference illumination, and the maximum illumination satisfies 84.9[%] of the reference illumination. However, as the illumination of desk planes is 864.20[lx], it meets the minimum reference illumination but does not meet the maximum reference value.

Also, in the case of the country, the average illumination of the general lighting is 131.82[lx], which does not meet standards of minimum-average-maximum illumination. The average of illumination of desk planes is 253.64[lx], which is 42.3[%] of the minimum reference illumination, 25.4[%] of the standard reference illumination, and 16.9[%] of the maximum reference illumination. In particular, since the country's case does not reach the minimum reference 1501[lx], the rural illumination is very poor for reading and studying.

The result is related with that the percentage of users who used a stand is 52[%]. When lighting is dark, it gives a dismal mood and fatigue to the user, reduces activity, causes an eyesight disorder, and damages health. Thus, a dark lighting should be exchanged into a lamp with a high quantity of light or lamp instrument should be added to improve illumination. In particular, local lighting, that is, a stand, should be secured to improve the illumination of a desk plane.

Table 9 shows the result presenting the uniformity ratio(%) of an inside space in the illumination measurement of a study room. In the average value of the uniformity ratio, the city is 36.36[%], and the country is 35.6[%], which indicates that they all are appropriate for the recommendation value 30[%]. However, since the uniformity ratio is good but the general

illumination is low, it is not a good result.

**Table 9. The Uniformity Ratio(%) of an Inside Space**

Classification	Region			N(%)
	City	Country	X <sup>2</sup>	
20 or less	18(12.9)	21(15.2)	277.048*	
21-30	34(24.3)	28(20.3)		
31-40	32(22.9)	36(26.1)		
41-50	32(22.9)	33(23.9)		
More than 51	24(7.1)	20(14.5)		
M(SD)	36.36(.146)	35.87(.149)		

Significance level \*p<.05

### 3.4 Satisfaction of illumination environment of users

The research investigated the dazzling and brightness of lighting, the fatigue of the eye, the shading by lighting instrument, the satisfaction for the heat of lighting instrument, the satisfaction of the general lighting environment of the current study room, using a 5-point likert scale, when a user use lighting instrument.

The result that investigated the satisfaction of users on lighting environment shows that the city has a higher satisfaction than the country. Also, in the satisfaction on the lighting environment of the current study rooms, 69.8[%] of the urban families were satisfied and 3.4[%] of them were dissatisfied. In the case of the rural families, 66.9[%] of them were satisfied, and 11.2[%] of them were dissatisfied. In particular, we could know that the rural families lacked the recognition for lighting because they were highly satisfied despite the low illumination in their study room. Since they were used to live in dark environment for a long time, they need to improve for their right consciousness for lighting.

## 4. Conclusion

The result that investigated the status of the lighting environment of study rooms of the urban and rural juveniles shows that general and local lightings all lacked in both regions. In addition, since the illumination of desk planes, which can obtain more illumination by local lighting, were poorer, the use of local lighting, that is, a stand, should increase. If the illumination in a space for juveniles to study is low, juveniles can easily feel the eyes fatigue. When a student reads a book, an illumination of more than 3 times of general lighting is needed around the book.

Thus, in order to satisfy the illumination of general lighting, lighting designers should make efforts. In addition, it is important that people recognize a right method to use lighting by learning recognition for lighting. Also, when viewing that the demand for only the design and performance of lighting instrument increases without efforts for an improvement of brightness such as exchanging lighting instrument and using a local lighting, practical efforts to increase illumination of lighting instrument is needed.

As research on the lighting for the living room has been being studied, the illumination necessary for the living room has continuously increasing. On the contrary, research on the illumination of kitchen or study room, in which visual work is needed, is very poor. The improvement of the lighting of a study room from the terms of quantitative aspect should be rapidly carried out, and further research related with visual work such as color rendering and dazzling phenomena, brightness distribution, and so on should be variously conducted.

## References

- [1] Hyunji Kim and Okhee An, "Investigation on the lighting environment of study rooms in single-family house" Korean institute of illuminating and electrical installation engineers, 2005.
- [2] Okhee An and Hyunji Kim, Color and lighting design, Gimdoondang, 2008.
- [3] Hyeelim Yun, Practical task of lighting design, Sungandang, 2002.
- [4] Korean standards association, KS handbook lighting 1, 2000.
- [5] Youngsek Han, "Analysis on the status of the lighting environment of classrooms and study rooms," Chungju National Univ., Electrical Engineering Dept., Master's thesis, 2002.

## Biography

### Hyun-Ji Kim

Kim, Hyun-Ji was born in 1968. In 2000, She awarded the degree of doctor of Housing study in Yeungnam University. Now she serves as a visiting professor of department of Family & Housing studies in Yeungnam University.

### Gyeong-Seon Jeon

Jeon, Gyeong-Seon was born in 1969. In 2008, he got her master's degree in Housing study at University of Yeungnam. Now she teaches Domestic studies in Maejun middle school

### Ok-Hee An

An, Ok-Hee was born in 1961. In 1990, She awarded the degree of doctor of Human Ecology in Nara Women's University in Japan. Now she serves as a professor of department of Family & Housing studies in Yeungnam University.