

A Study on the Actual Condition of Illumination Environment in Public Libraries in Daegu

Ji-Eun Seo* · Hyun-Ji Kim · Sung-Hwa Kim · Ok-Hee An**

Abstract

This study investigated the actual condition focusing on the lighting environment which is a major element in aspect of indoor environment of a public library and assessed user satisfaction. Research results are as follows:

Firstly, numbers of lighting fixtures per dimension of a reading room in a public library were inconsistent due to the lack of definite regulations, which was found to have negative effect on night time illuminance.

Secondly, it was assessed that illuminance between the day time influenced by natural lighting and in the nighttime without natural lighting has more than 10-fold difference. Therefore, such a condition is judged to be inappropriate for lighting environment of a reading room where users spend a long time studying and thus, it is considered that an appropriate measures should be taken.

Thirdly, as the survey result on users' satisfaction with lighting environment was revealed to be lesser than 3 points, lighting plan in consideration of its users should be progressed.

Key Words : Public Library, Lighting Environment, Illuminance, Satisfaction

1. Introduction

1.1 Research Background & Objective

Our country, achieving a high economic growth, had an explosive increase in seen its knowledge and increase in knowledge and technology while undergoing rapid changes in various fields such as

politics, economy, society and culture, etc. Such a knowledge-based information society will possibly develop more rapidly in the future and to cope actively in the diversified, specialized, and complicated society, prompt collection of information and sustained education of life-long education is necessary.

Representative example of a social education facility taking full charge of such education is the library and our National Constitution stipulates that "a nation is obligated to promote life-long education." As a part of it, national, public libraries have been established and managed by the government policy program.

In the past, libraries were regarded as 'a

* Main author : Yeungnam University
** Corresponding author : Yeungnam University
Tel : +82-53-810-2865, Fax : +82-53-810-4667
E-mail : sjieun@ynu.ac.kr
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building with gathered up books' and the main function was simply allowing the users to make use of the collected, arranged, preserved books, paintings and other data, whereas the previous paradigm of simple data supply is changing to a user-oriented paradigm according to environmental transition of rapid information society. Also, the current library is transforming into "a user-satisfaction-oriented library" equipped with a variety of facilities and programs to maximize users' satisfaction[1]. Thus, public library is developing rapidly in terms of social culture education, but developmental level of indoor environment is still in its infancy due to managers' lack of consciousness, insufficient regulations and negligence in management, etc. In addition, as research is focused on policy-making, management system, infra establishment, and post of librarians through an administrative approach. so research on its actual users is insufficient about public library. because they are installed and operated by municipality.

Therefore this study is aimed on the importance of indoor environment to find the solutions for problems within a public library. This study is also aimed at gathering information needed for space planning a public library reading room [an individual study room][2] by grasping the actual condition of elements in lighting environment among indoor environment of reading rooms in previously built public library and investigating, analyzing the users' recognition, in considering that reading rooms take up the most space of a library and 30 percent of the main using purposes are for individual study.

1.2 Research Range and Method

The target space of this research was a reading room with the most weight among municipal

libraries in Daegu district. This study was progressed to investigate the actual condition of indoor environment and users satisfaction.

Substantial research procedures are as follows:

Firstly, this research performed theoretical consideration on public library through reference literatures and preceding research.

Secondly, this research compared and analyzed the illuminance of total 17 reading rooms among all 8 municipal public libraries located in Daegu Metropolitan City, together with the decision of measuring period by making a preliminary survey.

Thirdly, this research used Likert 5-point measurement of users sitting in the reading room to investigate users' satisfaction on reading room lighting environment. Investigated data went through assessment of frequency, percentage, average value, and standard deviation using SPSS WIN Program and user satisfaction was comparative analyzed by T-test.

Lastly, through the analyzed results, this research proposed the planning method of public library lighting environment for the future based on the analyzed results.

2. Theoretical Considerations on a Public library and its Environment

2.1 Concept & Classification of a Library

"Library" is a facility that contributes to cultural development and life-long education such as data usage, investigation, research and learning education by gathering, arranging, preserving and accumulating data materials of a library and offering the usage of public to a particular person[3]. In other words, the aim of a library is to offer data materials to users.

To sum up the definition of a public library through such research contents, a library is opened equally to everybody and can be called as “an overall social education center” for information, education and culture of local community.

2.2 Function of a Public Library

For a public library to perform its function as the information & culture education center for local residents, ① gathering, arranging, preserving and accumulating data, and usage of the public ② offering information necessary for the public ③ offering data necessary for local administration and industrial fields. ④ establishing a plan and everyday reading ⑤ holding or encouraging lecture meetings, appreciation shows, exhibitions, reading clubs, and other cultural activities & life-long education program ⑥ close cooperation and data exchange with other libraries or mutual lending & borrowing ⑦ inquiry & research on library business and ⑧ implement other business needed for its function as a public library should be carried out. In addition, other than collecting, organizing (classification, compilation), preserving and providing library data, public library has the functions such as habituation of reading, continuation of education, enhancement of creative power, promotion of culture, succession of history, distribution of information, and a crusade against semi-illiteracy[4].

2.3 Standard of Public Library Lighting Environment

The standard of light environment for public library indoor environment includes installation of direct lighting system in areas for data and user, and illuminance maintainment of general reading

room and open shelves at 300~500[lx] and closed shelves at 100~200[lx][5].

3. Actual survey on a Public Library

3.1 General matters on a research subject

<Table 1> shows the general matters such as the foundation year, aggregate floor space and the number of users of a library building.

To take a look at the overall general matters, municipal public libraries in Daegu Metropolitan City were built the mostly in the 1980s and the oldest is L library. N library, built most recently, is also found to be more than 10 years old.

Table 1. General fact of subject library

M	L.C	F.Y	F.A([m ²])	Size
N	Namgu	1995.08	7,533	Ground 4th floor
D	Junggu	1987.06	5,065	Ground 4th floor
O	Donggu	1995.93	7,396	Underground 1st floor, Ground 4th floor
L	Dalseogu	1981.08	3,600	Underground 1st floor, Ground 4th floor
B	Bukgu	1983.10	4,612	Underground 1st floor, Ground 3rd floor
S	Seogu	1992.12	7,137	Underground 1st floor, Ground 5th floor
J	Junggu	1985.12	10,150	Underground 1st floor, Ground 4th floor
H	Suseong gu	1988.12	5,827	Underground 1st floor, Ground 3rd floor

* M:Library name, L.C:Location,
F.Y::Founding year, F.A:Total floor area ([m²])

The aggregate floor space of a building is 3,600 ~10,150 square meters wide and the difference in aggregate floor space is very large; the biggest is J library and the smallest is L library. There

appeared a great difference in the largest and smallest number of users between libraries. For example, there appeared about 3 - fold difference in the number of users between J library which has the largest number of users and D library which has the smallest number of users. In other words, it was found that there exists a great difference in general matters according to each library.

3.2 Occupancy Rate of Reading Room by Users

This study took a look at the occupancy rate of a reading room by comparing the number of users of a reading room and number of seats in a reading room on the very date as reading room is the substantial target of this research <Tab. 2>.

Table 2. Number of users and occupancy rate

m	Dividing	Reading room of man		Reading room of woman		Reading room of Common use	
		n	[%]	n	[%]	n	[%]
N	day	145	54.9	92	76.7	65	54.2
	night	110	41.7	61	50.8	46	38.3
D	day	34	26.6	39	38.6	-	
	night	24	18.8	20	19.8	-	
O	day	13	12.0	30	31.3	-	
	night	20	18.5	17	17.7	-	
L	day	-		-		78	43.3
	night	-		-		108	60.0
B	day	155	76.7	76	33.3	54	60.0
	night	109	54.0	91	39.9	64	71.1
S	day	198	84.6	102	38.6	-	
	night	72	30.8	83	31.4	-	
J	day	118	57.8	118	42.8	-	
	night	43	21.1	79	28.6	-	
H	day	132	38.6	149	55.2	-	
	night	99	28.9	97	35.9	-	

Reading rooms were divided into rooms for men, women and common use, and individual room formation was found to be different for each library. Through <Tab. 2>, it was found that the number of users using a public library ranges from 13 up to 155, and each library occupancy was found to be from 12.0[%] to 84.6[%]. Such a result explains that there exists a great difference among the libraries and their reading rooms, and on the whole, the occupancy rate during the night time was found to be low.

3.3 Facility Situation of Reading Room

The result of the facility situation related to reading room lighting environment in a public library is shown in <Tab. 3>.

Table 3. The facility condition of illumination environment

Library name		area /1 per (area standard /1 per : 1.76[m ²])	[%] about window area/floor space	F.L (32W)
N	man	264seats /1.38[m ²]	58.9[m ²]/16.5	144
	woman	120 seats /1.56[m ²]	28.0[m ²]/15.0	72
	common	120 seats /1.53[m ²]	44.2[m ²]/24.1	72
D	man	128 seats /0.96[m ²]	29.0[m ²]/23.6	46
	woman	101 seats /1.03[m ²]	33.8[m ²]/32.4	53
O	man	108 seats /0.88[m ²]	24.2[m ²]/25.6	60
	woman	96 seats /1.39[m ²]	29.1[m ²]/21.8	60
L	common	180 seats /1.37[m ²]	42.8[m ²]/17.3	82
B	man	202 seats /1.53[m ²]	78.3[m ²]/25.3	84
	woman	228 seats /0.83[m ²]	35.0[m ²]/18.6	60
	common	90 seats /1.46[m ²]	17.4[m ²]/13.3	32
S	man	234 seats /1.15[m ²]	33.9[m ²]/12.6	36
	woman	264 seats /1.33[m ²]	48.1[m ²]/13.7	35
J	man	204 seats /0.97[m ²]	56.3[m ²]/28.5	108
	woman	276 seats 석/0.94[m ²]	29.8[m ²]/11.5	144
H	man	342 seats /1.16[m ²]	270석/1.16[m ²]	192
	woman	80. eats/20.1[m ²]	98.5[m ²]/31.6	72

4. Assessment of public library lighting environment

4.1 Measurement of reading room lighting environment

4.1.1 Measurement & Survey Method

To assess the lighting environment of a public library, this research conducted a positive survey.

Firstly, we assessed the current situation of lighting environment and secondly, we surveyed user satisfaction regarding lighting environment.

To explain the survey method concretely, the first survey was conducted from March 20, 2006 until April 7, 2006 and preliminary survey from March 20 until March 25 was performed in advance to survey and analyze the transitional trend of reading room lighting environment and behavioral pattern of the reading room users. From the result, there appeared to be a difference in lighting environment before and after sunset. Thus, first measurement was done between 1 pm and 3 pm before sunset and second measurement between 7 pm and 9 pm after sunset. In addition, the survey was conducted only on a clear day to prevent influence from outside weather. Measuring location was set at the height of a desk using 5-point measurement and assessed average value and symmetry by using a digital illuminometer.

A second survey was conducted to inquire satisfaction of lighting environment and survey items were drawn up by referring to the preceding research and supplemented by the preliminary survey <Tab. 5>.

In addition, 5-point Likert measurement was used in the assessment of satisfaction. Subjects were the users sitting in the reading room on the day of actual measurement. Questionnaires were distributed once at 3 pm, when the number of users was the most as the users in the day and

night time were found to be mostly the same. 912 questionnaires were collected from 1,003 [collection rate: 91[%]], and analysis was made on 828 collected questionnaires except the ones with unfaithful response [analysis rate: 91[%]].

4.1.2 Results of Measurement

To arrange the surveyed results as explained in <4.1.1>, the results are shown in <Tab. 4>.

To analyze the lighting environment of a reading room through <Tab. 4>, the illuminance of the N library reading room of mostly met the standard range, but it was found to be very high at two points on the window side [1,310[lx] and 1,180[lx] respectively] and the center of the reading room appeared to be very low- 175[lx], showing the lowest symmetry [13.4[%]]. Consequently, it is judged that there should be an improvement in illuminance along with an active light-intercepting plan.

In the case of D library, overall illuminance was satisfactory, but it was found that the average illuminance of the reading room for women in the daytime was 4,428[lx], showing an excess of the standard range. Such results were due to the fact that desk illuminance[15,800[lx]] on the edge of wall sides that consist windows were very high. Therefore, it is considered that light-intercepting facilities such as blind or dust-free curtains on the windows of reading room for women are necessary.

To analyze the illuminance of O library, the two reading rooms in the nighttime met the standard range, but its symmetry was found poor, showing 36.4[%] on the average. To analyze the lighting environment of L library reading room, there appeared a great change in illuminance according to a daily range, and the illuminance at nighttime failed to meet the permissible standards. Besides, symmetry was also found to be poor. Thus, it is

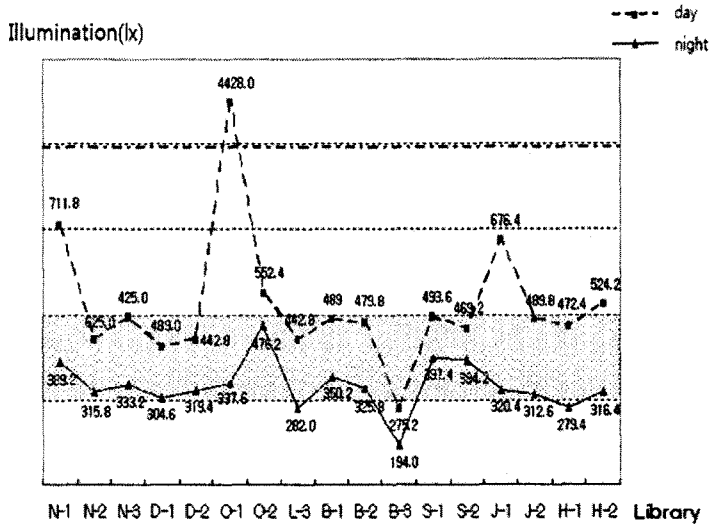


Fig. 1. Result of luminous intensity measurement at day and night

considered that there should be an improvement plan for a balanced shunt of illuminance.

In case of B library, its illuminance mostly met permissible standards, but the illuminance of a reading room for common use was found to be very poor, staying below standards. As for symmetry, there appeared a deep illuminance deviation of reading rooms for men and women in the daytime. Therefore, it is judged that there should be preparations for a balanced illuminance distribution in all reading rooms and measures to install lighting facilities for a reading room for common use.

To assess the lighting environment of S library, illuminance was all within the standard range, but symmetry was found to be low, except the reading room for men. Therefore, it is considered that S library should also set up a measure for a balanced illuminance distribution.

In case of J library, the illuminance of a reading room for men in the daytime was found to be the highest, showing 676.4[lx] on the average, but four points were found to exceed 700[lx] in point measurement and the edges of the wall sides were

measured to be 282[lx], with resultant low symmetry [35.1(%)], having a poor environmental

Table 4. The measurement result of illumination environment in reading room

M	Section	man		woman		Common use	
		Day	Night	Day	Night	Day	Night
N	Illuminance.	711.8	389.2	440.6	315.8	496.0	333.2
	URI	13.4	54.3	57.9	65.1	51.3	55.8
D	Illuminance.	425.0	304.6	442.8	319.0	-	
	URI	31.6	63.4	3.0	64.8	-	
O	Illuminance.	625.0	337.6	552.4	476.2	-	
	URI	23.7	38.2	36.3	47.3	-	
L	Illuminance.	-		-		442.8	282.0
	URI	-		-		33.4	45.4
B	Illuminance.	489.0	350.2	479.8	325.8	275.2	194.0
	URI	32.6	48.0	25.1	67.1	4.5	42.2
S	Illuminance.	493.6	397.4	469.2	394.2	-	
	URI	60.1	32.1	34.3	38.2	-	
J	Illuminance.	676.4	320.4	489.8	312.6	-	
	URI	35.1	49.3	57	73.3	-	
H	Illuminance.	472.4	279.4	524.2	316.4	-	
	URI	23.4	43.7	20.3	32.2	-	

* Illuminance ([lx]), URI (uniformity ratio of illuminance)(%)

status. Illuminance besides these parts generally met the standard range and reading room for women with symmetry of 73.7[%], proved excellent lighting environment in particular. To assess the lighting environment of H library, the illuminance of a reading room for men in the nighttime was the lowest, showing 279.4[lx] and the two reading rooms in the daytime were found to have less than 25[%] symmetry, proving inconsistency in illuminance distribution.

4.2 Comparative Analysis of Lighting Environment between libraries

This research conducted comparative analysis of lighting environment measurement results between reading rooms in various libraries. The analysis results are shown in [Fig. 1].

[Fig. 1] revealed that there appeared a high illuminance in the daytime when reading room was influenced by natural lighting. Particularly, in case of the reading room for women in D library, daytime illuminance was found to be 4,428[lx],

showing a big difference of over 10-folds high compared to nighttime (319.4[lx]). The reading rooms with illumination results of day & nighttime that meets the permissible standards, were found to be the reading room for women and common use in N library, reading room for men and women in D library, reading room for men and women in B and S library and reading room for women in J library. However, the reading room for common use in B library was found to be below standard for daytime[275.2[lx]] and nighttime[194.0[lx]], showing a big difference comparing to other reading rooms in the same library.

4.3 Users' Satisfaction of Lighting Environment

4.3.1 General Facts of Survey subjects

The general matters of reading room users for each library are shown in <Tab. 5>. <Tab. 5> shows that the age range of reading room users are highest from 25 to 29 and their occupations are mostly students.

Table 5. General facts of survey subjects

Factors	Section	N	D	O	L	B	S	J	H
Sex	man	116 (58.6)	29 (49.2)	26 (40.6)	56 (94.9)	68 (48.9)	44 (44.9)	38 (62.3)	71 (47.3)
	woman	82 (41.4)	30 (50.8)	38 (59.4)	3 (5.1)	71 (51.1)	54 (55.1)	23 (37.7)	79 (52.7)
Age	Below 19 year-old	8 (4.0)	2 (3.5)	27 (42.2)	3 (5.1)	16 (11.7)	18 (18.4)	18 (29.5)	57 (38.0)
	20 ~24	46 (23.3)	15 (25.4)	12 (18.7)	12 (20.3)	30 (21.9)	24 (24.5)	20 (32.8)	39 (26.0)
	25~29	89 (44.9)	31 (52.5)	16 (25.0)	17 (28.8)	48 (35.0)	43 (43.8)	16 (26.2)	24 (16.0)
	31 or older	55 (27.8)	11 (19.6)	9 (14.1)	27 (45.8.)	43 (31.4)	13 (13.3)	7 (11.5)	30 (20.0)
	M (SD)	28.8 (6.59)	27.9 (6.73)	23.0 (9.98)	30.6 (8.66)	27.2 (7.59)	25.1 (5.97)	23.3 (5.61)	23.9 (9.63)

4.3.2 Assessment of Users' Satisfaction

This research conducted a survey and analysis regarding the users' satisfaction, of reading rooms.

The satisfaction of questionnaire content: "Lighting in the reading room is bright enough for reading books" was measured by 5-point Likert and its result is shown in <Tab. 6>.

Table 6. The satisfaction degree of illumination environment

M	Section	Man	Woman	Common use
N	M(SD)	3.16(0.94)	3.03(0.93)	2.82(0.94)
D	M(SD)	2.55(0.74)	2.40(0.81)	-
O	M(SD)	3.27(1.00)	3.53(1.08)	-
L	M(SD)	-	-	2.90(0.92)
B	M(SD)	2.79(1.01)	2.89(1.02)	2.98(0.95)
S	M(SD)	2.84(0.81)	2.59(1.16)	-
J	M(SD)	2.97(1.05)	2.83(0.98)	-
H	M(SD)	2.92(0.97)	3.06(0.94)	-

* Illuminance ([lx]), URI (uniformity ratio of illuminance)([%])

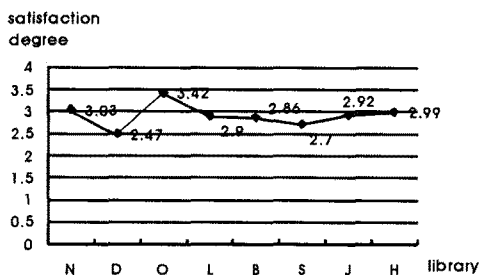


Fig. 2. The satisfaction degree of total

Assessing satisfaction with lighting environment through <Tab. 6>, O library ranked first in users' satisfaction regarding reading rooms for men and women [male:3.27, female:3.53], while D library ranked lowest in users' satisfaction [male:2.55, female:2.40]. Thus, lighting environment of a reading room for men and women has great difference between libraries. Nevertheless, in case of reading room for common use, users'

satisfaction of lighting environment was assessed almost similarly.

To compare the results(Fig. 2) of lighting environment in all reading rooms, O library ranked first in users' satisfaction [3.42] followed by N library[3.03].

5. Conclusion

This study focused on the importance in terms of public library indoor environments, grasped actual condition based on lighting environment being the most important element, and assessed users' satisfaction. The assessment results are as follows:

Firstly, results of investigating the actual condition of public libraries showed that most libraries have aged facilities as they were built more than 10 years ago.

Secondly, result of investigating the situation of lighting facilities in public library reading rooms showed difference in the number of lighting facilities per dimension of each reading rooms, which was found to have a negative effect on the illuminance in nighttime. Therefore, extension of fluorescent lamps in consideration of nighttime illuminance in is very urgent.

Thirdly, results of comparing the measurements of elements regarding reading room lighting environment showed that there existed more than 10-fold difference in illuminance between daytime which is influenced by natural lighting and nighttime which is free from natural lighting. Therefore, such reading room lighting environments are judged to be inappropriate for long time studying and it is judged that there needs to be a proper measure against it.

This research was done on an actual condition and satisfaction with lighting environment by setting April as a basic month, so there exist some

limits to applying this research data to general lighting plans. Therefore, follow-up research on changes in lighting environment elements subsequent to seasons should be done, and it is considered that extended research on public libraries in all districts including Daegu Metropolitan City is urgently needed.

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Biography

Ji-Eun Seo

Seo, Ji-Eun was born in 1975. She awarded the degree of doctor of architectural engineering in Kyungpook National University in 2007. Now she serves as a full-time lecturer of department of Family & Housing studies in Yeungnam University.

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.

Sung-Hwa Kim

Kim, Sung-Hwa was born in 1970. In 2000, She awarded the degree of doctor of architectural engineering in Kyungpook National University. Now she works for Sam Hyup Architectural Design office.

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.