

Study on the Effects of Learning by Changing the Color-Temperature LED Lamp

Ik-soo Eo and Keum-yeon Choi

Honam University, Gwang-Ju City, Korea
iseo@honam.ac.kr

Abstract

This paper was used as a classroom ceiling, fluorescent lighting currently installed using LED light sensitivity. The mood of the music room and art room created by the room color and lighting can improve a learner's creativity. Approximately 3,000K color-temperature lighting can affect various senses of a student. A psychological assessment of students was carried out under classroom illumination using Relux software. LED replaced the fluorescent lighting in the classroom. As a result, learning increased by approximately 25% with the LED lamps than with fluorescent lamps. In addition, the average illuminance was derived from the illumination law.

Keywords: LED, Color-temperature, Emotional-lighting, Relux

1. Introduction

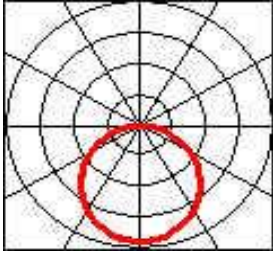
The main purpose of lighting is to provide comfortable vision, efficiently. The appropriate lighting environment improves business skills and vision characteristics. Increased awareness of energy conservation worldwide has demanded advanced energy sources. The LED (Lighting Emitting Diode), a light source using a semiconductor, has developed into a new lighting technology of much interest [1, 2]. LED lighting systems have advantages over conventional light sources, they have high efficiency and low power-mad can be made into various shapes to provide a wide range of luminous intensities, and provide emotional illumination and illuminant color changes, such as high color rendering. Thus, LED lighting technology has been applied for general lighting, displays and in automotive, medical, and agriculture fields. As optics, heat, circuits, systems and design. In addition, recent developments have been on creating a pleasant lighting environment for the occupant of that environment. At first, the psychological aspects of lighting comfort was rated subjectively; since then, they have been rated objectively to assess physiological changes in the occupant [3, 4]. This paper investigates the effect of LED lighting installed in a classroom on student psychology. The mood of the music room and art room created by the room color and lighting can improve a student's creativity. Approximately 3,000K color-temperature lighting can affect various senses psychological assessment of students were carried out in a classroom where the fluorescent lighting had been replaced by LED lightning using Reflux software.

2. Theory

2.1. Experimental Procedure

A simulation program was Relux. A school classroom was simulated. 42W LED lamp × 8 (FL Type) was purchased. Simulation conditions are provided in Table 1.

Table 1. Simulation Conditions

Place		Classroom
Size		7.5m × 9m × 2.5m
Reflectivity	Ceiling	0.9
	Walls	0.85
	Floor	0.85
Lamp		LED(0.2W x 192EA), 42W
Luminaires Size		600 x 600mm
Light Distribution Curve		 <p>Lamp Type: Lambertian</p>

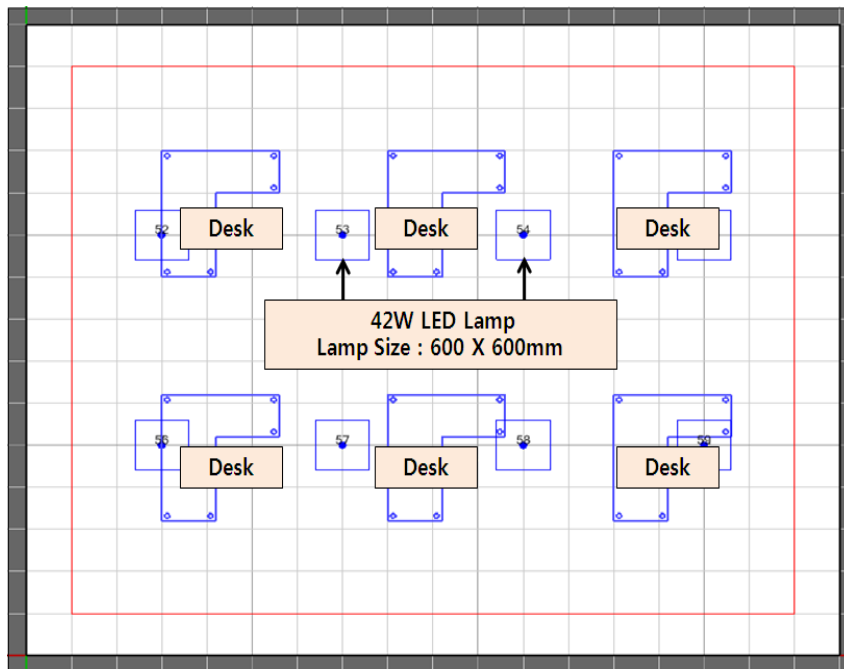


Figure 1. Layout Drawings of Classrooms and Fixtures

Figure 1 is a representation of the classroom and lighting equipment layout used in the simulation. LED (0.2W × 192 EA), Color-temperature 3,000K, 42W luminaires were placed in a 600 × 600mm LED module. Landscape lighting design consisted of four columns and two rows of lighting.

2.2 Experimental Analysis

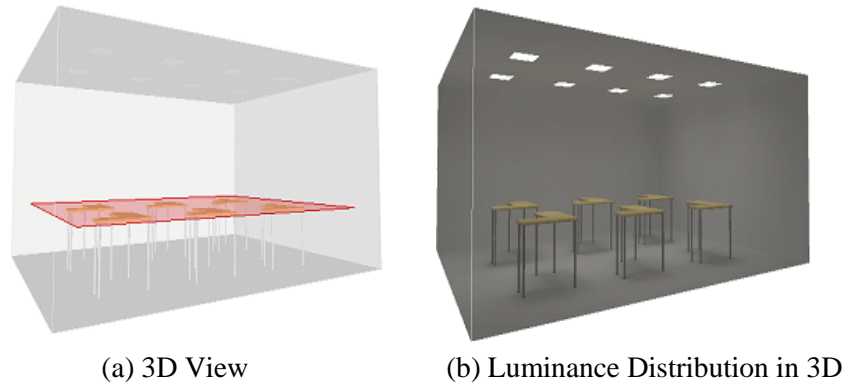


Figure 2. 42W LED Lamp × 8 (FL Type) 3D View

Figure 2 shows the simulation results of LED lamp light distribution in 3D View. Figure (a) and (b) are the results of the LED lamp light distribution on a 3D floor plan.

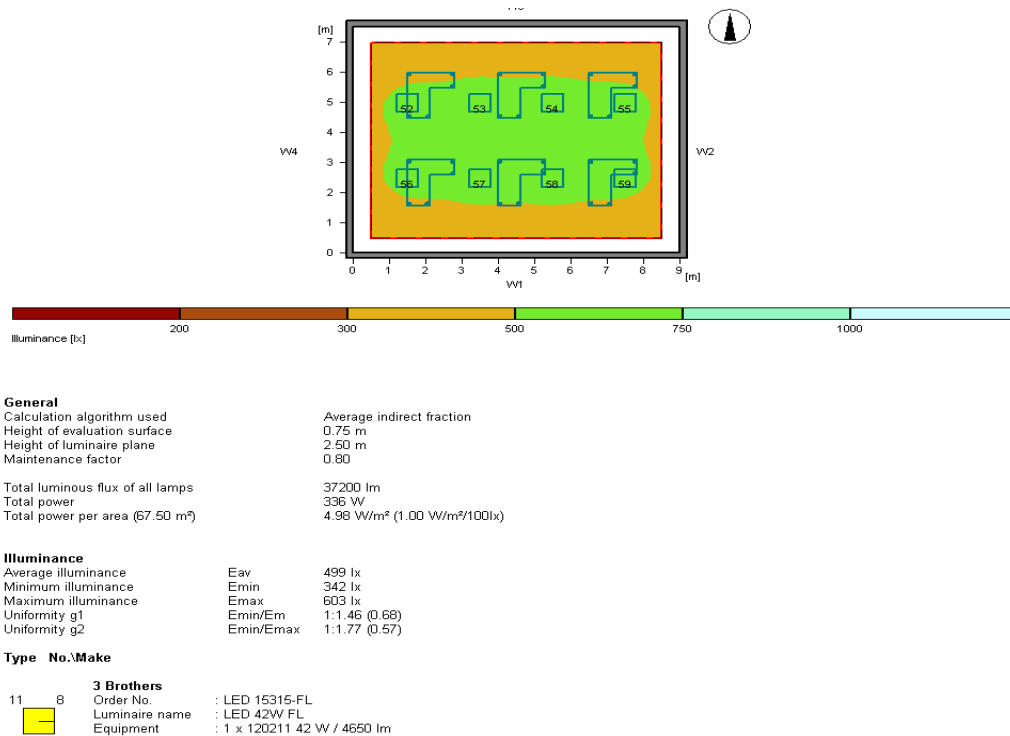


Figure 3. 42W LED Lamp × 8 (FL Type) Calculation Results

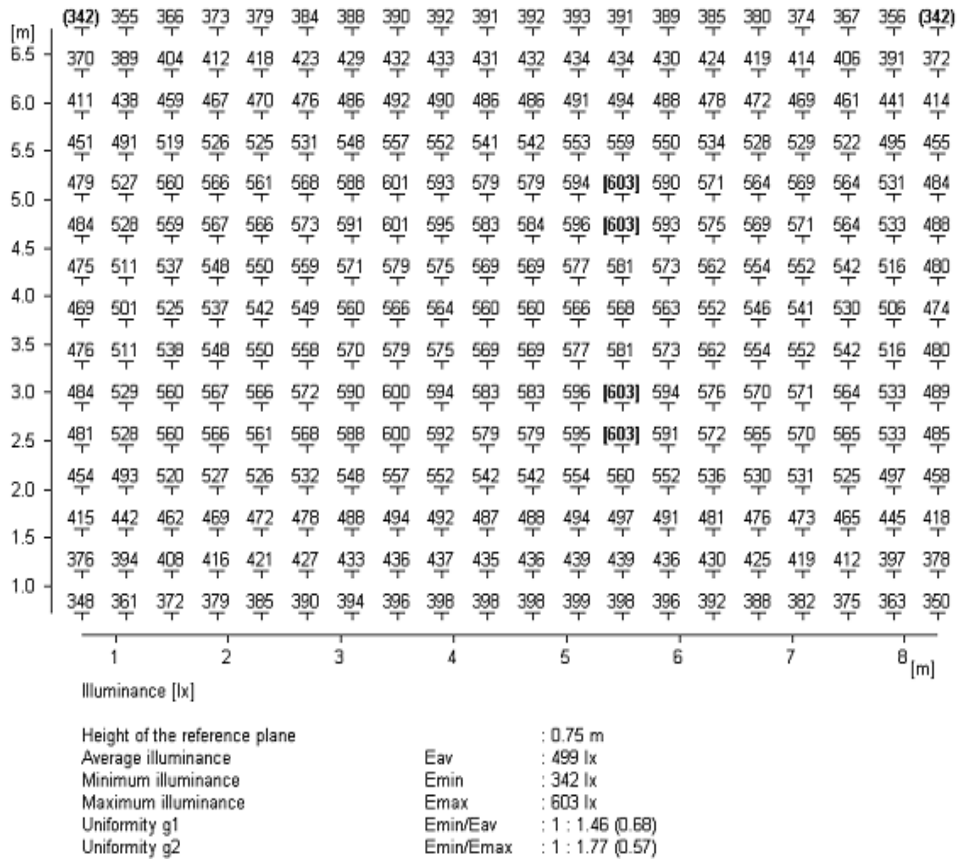


Figure 4. 42W LED Lamp x 8 (FL Type) Illuminance Distribution

Figure 3 and Figure 4 shows the simulation results of the intensity distribution in the classroom installed with LED lamps. 42W LED lamp x 8 (FL Type) 4,650lm was installed eight of LED lamp when the result value is the full beam was measured speed of light 37,200lm, power 336W, average roughness of the 499lx, and a minimum illumination 342lx, the maximum roughness 603lx.unclear Illumination of the desk was manned by part 540 ~ 600lx If you compare the distribution of the illumination the LED lamp. In addition, the intensity distribution of outer shell was 400lx or less.

Table 2. Illuminance of Korea Industrial Standard (KSA-3011)

Space	Illumination Classification	Illumination (lx)
Classroom	G	300-400-600

The simulation results were based on the Illuminance of the Korea Industrial Standard (KSA-3011), as shown in Table 2 for fit.

2.3. Apply Emotional-lighting Surveys



(a) General Fluorescent (2/40W FL) (b) LED Lamp (42W LED)

Figure 5. Lighting Installation Pictures

Figure 5 is a fixture in the classroom simulation Spec. and placed in the same general fluorescent lamps and LED lamp photos.

※ Please check the appropriate box √.

Survey (Fluorescent)	5	4	3	2	1
1. What do you think the brightness of the classroom?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Psychological stability of light do you think?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Fluorescent lights in the learning environment did become less effective?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Fluorescent less effective in the learning needs did have?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Fluorescent lighting is less effective in learning outcomes happened?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Fluorescent in this study, please describe the advantages and disadvantages.					
Total Points					

※ Please check the appropriate box √.

Survey (Fluorescent)	5	4	3	2	1
1. What do you think the brightness of the classroom?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Psychological stability of light do you think?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Fluorescent lights in the learning environment did become less effective?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Fluorescent less effective in the learning needs did have?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Fluorescent lighting is less effective in learning outcomes happened?	Very Satisfied	A Little Satisfaction	Usually	Slightly Dissatisfied	Very Dissatisfied
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Fluorescent in this study, please describe the advantages and disadvantages.					
Total Points					

Figure 6. Survey Form

Figure 6 is an emotional and learning assessment questionnaire for the lighting installed. Survey results are as follows LED brightness was more satisfactory than fluorescent brightness. (25% Increase); fluorescent light from the LED provided more psychological stability. (30% Increase); LED lamps provided a more positive learning environment (25% Increase); learning improved with LED lamps than with fluorescent lamps (25% Increase); and more positive feeling resulted from LED lamps than from fluorescent lamps (25% Increase).

3. Conclusion

This paper investigated the effect of LED lighting in the classroom on student psychology. The mood of the music room and art room created by room color and lighting can improve student creativity. Approximately 3,000K color-temperature lighting can affect various senses of a student. Psychological assessment of students was carried out under classroom illumination where fluorescent lighting was replaced by LED using Relux software. Eight LED lamps of 42W LED lamp× 8 (FL Type) 4,650lm were installed, they provided speed of light 37,200lm, power 336W, average roughness of the 499lx, minimum illumination 342lx, and maximum roughness 603lx. Illumination of the desk was manned by part 540 ~ 600lx If you compare the distribution of the illumination the LED lamp. In addition, the intensity distribution of the outer shell in the classroom was 400lx or less. The simulation results, which were based on the Illuminance of Korea Industrial Standard (KSA-3011), were as follows, students were more satisfied with LED brightness than with fluorescent brightness (25% Increase), fluorescent light from the LED provided more psychological stability (30% Increase), LED fluorescence created a more positive learning environment (25% Increase), learning improved with LED lamps than with fluorescent lamps (25% Increase), and LED lamps created more a positive feeling than fluorescent lamps. (25% Increase)

Acknowledgements

This study was supported by research fund from Honam University, 2013.

References

- [1] S. -D. Jee, K. -J. Choi, H. -K. Kim and S. -H. Lee, "Sensibility Evaluation of Color Temperature and Rendering Index to the LED-Based White Illumination", Korean Journal of The Science of Emotion & Sensibility, (2006) December.
- [2] H. -K. Yang, H. -W. Ko, M. -H. Kim, S. -K. Lim and Y. -H. Yun, "Evaluation of Fatigue by Analysis of Relation between Subjective Rating Score and Working Performance with Color Temperature", Korean Journal of The Science of Emotion & Sensibility, (2001) December.
- [3] D. Willard, J. E. Cobble, S. J. Gertel and H. Jolly, "Color in an Optimum Learning Environment", International Center for Leadership in Education, (2008) March.
- [4] S. -D. Jee and C. -B. Kim, "Subjective Evaluation on the Color Temperatures of LED illumination in the Classroom", Journal of the Korean Institute of Illuminating and Electrical Installation Engineers, (2011).

Authors



Ik-Soo Eo

He received the Ph.D. Seoul Venture Information School, Department of Electrical Engineering at Korea, in 2008 respectively. He is a Professor in the Electrical Engineering at Honam University at Kwang-ju Korea. His current researches are interest heat-sink design and optical design of lighting.



Keum-Yeon Choi

He received the Master Degree in Honam University Electrical and Electronics graduate school at Korea, in 2010 respectively. He is a doctor's course student in the Electrical Engineering at Honam University at Kwang-ju Korea. His current research interests are heat-sink design and optical design of emotional lighting.

