

THE EFFECT OF LIGHT

- How Dynamic LED Lighting can improve Sleep Quality

A popular science summary of master's thesis

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Until recently, light has only been defined in terms of the human visual system. However, discoveries in the late 1990s revealing the relationship between light exposure and the inner biological clock, led to an understanding of the importance of light regulation for human health, wellbeing and furthermore maintaining the sleep-wake cycle. This master's thesis presents an interventional study revealing results suggesting that a dynamic light intervention, programmed to follow the natural daylight pattern, leads to improved sleep quality.

Today, the majority of the Scandinavian population spend on average 85 percent of their time indoors, making the artificial light the primary source of light. Further known, both natural and artificial light is needed in order to obtain visual information. However, increasing evidence suggests that the brightness and wavelength of ambient light is not only important for task completion, but that it can also have strong non-visual biological effects. The light additionally regulates the human circadian system and impacts upon the biological clock, mood and alertness. Modern development of light sources and systems should therefore consider both visual and non-visual needs.

Previous studies have revealed the effects of different light characteristics on the circadian rhythm. According to Viola et al. exposure to blue shortwave light during daytime improves concentration and decreases experienced evening fatigue. Moreover, Figueriro et al. concluded that a two hour blue light exposure prior to bedtime revealed a late melatonin suppression of 38 percent, leading to delayed bedtimes and furthermore a disrupted circadian rhythm. In addition, the light sensitivity is increased in adolescents compared to adults, as reported by Crowley et al.

In conclusion, studies in the research field enhances the importance of light being adapted to time of day according to the circadian system. Consequently, automatically adaptable light regulation systems are fundamental. Even though several studies have been performed on the effect of light on the circadian system, research of the effect of dynamic lighting on particularly sleep quality has not yet been sufficient enough to conclude any results.

This master thesis aimed to evaluate the effect of a dynamic LED light intervention on sleep quality of school-aged children, by the implementation of a two week experimental study. The light intervention was programmed to mimic the natural daylight pattern to maximise the effects on sleep quality.

In order to quantify sleep quality it is necessary to assemble continuous measurements of both the stimuli to, and the response from the circadian system. Continuous measurements were obtained from activity trackers in addition to monitoring the light environment, in order to investigate the relationship. The results of the statistical analysis indicated a correlation between the exposure to the light intervention and improved sleep quality in terms of less number of awakenings and increased sleep efficiency.

The revelation is essential to create light regulation systems in school environments that in the future will be adapted to improve the sleep quality, alertness and performance of the students.

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Master's Thesis:

The Effect of a Dynamic LED Light Intervention on Sleep Quality of Adolescent Students