How Light Affects Sleep

Project Report

By

The Circadian RSM Team

We heard about The Bright Schools Competition, encouraging students to explore the link between light and sleep, sponsored by The National Sleep Foundation and National Science Teachers Association. It sounded interesting and fun, so we decided to participate.

First we went over the lesson plans with our coach and were intrigued to learn about Circannual and Circadian Rhythm. Circadian rhythms are changing physical and mental behavior in our body responding to light and darkness in an environment. Biological clocks control circadian rhythms. We learned that the circadian rhythm detects when it is time to sleep and to wake up, and influences the brain's production of melatonin.

It was fascinating to learn about the Electromagnetic Spectrum and how red light is most soothing for sleep but blue light with shorter wavelengths makes it hard to sleep. Although we had an idea that bright light at night can make sleep elude us but we did not know that the main contributing factor behind sleep deprivation for children is light and technology.

We decided to keep a sleep diary, collect our own data and understand these phenomenon for ourselves. For the next few weeks, we studied the impact of sleep hours vs. alertness in school, light at our desks vs. alertness in class, impact of bright screens before going to bed and sleep quality at night under different color lights. We used Fitbit to track sleep hours and manually used Lux Meter app to measure light in every class period. From the data we collected it was more than

obvious that good night sleep helped our alertness in school. Bright light in classroom helped us stay attentive and a good bedtime routine helped us get a good night sleep. Through our experiments we experienced firsthand how the red and blue light in our bedrooms affected our sleep quality.

Our literature search showed that Teens need about 8 to 10 hours of sleep each night to function best. Most teens do not get enough sleep. The circadian biological clock is controlled by a part of the brain called the Suprachiasmatic Nucleus (SCN), a group of cells in the hypothalamus that respond to light and dark signals. From the optic nerve of the eye, light travels to the SCN, signaling the internal clock that it is time to be awake. The SCN signals to other parts of the brain that control hormones, body temperature and other functions which then make us feel sleepy or awake. We found various articles talking about how in teenagers, melatonin levels in the blood naturally rise later at night than in most children and adults. Hence teens have difficulty going to bed early and getting enough sleep.

Based on our personal experience and talking to our friends we realized the major problem about proper sleep was awareness. Most children today are not aware of the negative impacts of technology on sleep and therefore are sleep deprived. So when it came to choosing between developing a prototype invention, creating an awareness campaign or writing up a proposal for a research project, the choice was clear for us. We decided to do an awareness campaign to spread the word and help as many students as possible. Interestingly, along the way, we came up with an app that we think can also help both our sleep quality and alertness during the day.

We made a video (How Light Affects Sleep: An Awareness Campaign) and posted it on YouTube (https://www.youtube.com/watch?v=WmIdPrPzles). We made presentations in school, which were very well received. We made a parody to grab attention of our fellow middle school

students. We were very successful in getting the word out about Circadian Rhythm and the strong connection between light and sleep quality.

As we manually conducted our experiment with Lux Meter, we realized it would be more efficient if an app could open Lux Meter periodically and link the reading to our activity from a device like “Fitbit”. For example, if we are in active mode and light intensity is low, it will send a warning signal. This gave rise to an app idea and we call our invention “Litbit”. We built an initial prototype Android app on our cell phones. Since we could not link it to Fitbit, currently this app turns on automatically at regular intervals and measures light intensity using Lux Meter. It basically reminds us to confirm if ambient light is appropriate for the current activity. So while promoting awareness about effect of light on sleep and our general well-being, we also developed a useful app.

Overall, working on this project has been a journey of discovery, we gained new knowledge on how to utilize technology without negatively impacting our sleep, we led a very successful awareness campaign, we had fun making and posting video on YouTube and helped hundreds of middle school students improve their sleep quality.

As future activity, we would like to explore going deeper into using our Litbit app in conjunction with Fitbit. Integrated properly, their synergy could be powerful. We would like to visit other schools in our district and present our experimental results and research findings. We would also like to increase awareness of other useful apps like F.lux that reduces blue light after dark and apps like Sleep Cycle and Food Sense. We feel we can help fellow students sleep better, eat well and feel great!

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