

EFFECTIVENESS AND POPULARITY OF BLUE LIGHT PROTECTION AMONG COLLEGE STUDENTS

Glen Steven Meador, Evan Zimmerman, Sarah Hinkley, O.D., FCOVD, FAAO, FNAP Michigan College of Optometry

Introduction

- Blue light emission from LEDs have been theorized to cause photo-toxicity to the retinal pigmented epithelium, cause digital eyestrain and disrupt sleep cycles.
- Blue light blocking technology has been marketed to mitigate the effects of blue light emission, despite lacking compelling scientific consensus that the theorized effects are valid.
- Out of the three effects, disruption of sleep cycles is perhaps the most well supported.
- This study's focus was to determine the perceived effectiveness of blue light blocking technology among college students.

Methods

- We targeted 86 Ferris State University students of all ages.
- Data was gathered using the QuestionPro survey application.
- The survey invitation was emailed out to all FSU students using the student email announcement system on four different occasions separated by a few days each. No identifying information was collected, other than age.
- Questions asked included:
 - Age
 - On average, how often do you use electronic devices?
 - On average, how many hours before sleeping do you use electronic devices?
 - Do you have trouble sleeping?
 - Do you have a diagnosed sleeping disorder?
 - Do you use any kind of blue light blocking application, glasses or devices when using electronic devices?
 - What blue light blocking technology do you use?
 - Do you experience noticeable relief from eye strain or increased comfort when using blue light blocking technology?
- Data was analyzed to determine any relationships between sleep, electronic device usage and blue light protection.

Results

- A majority of participants were between the ages of 18-23 (74 of the 86).
- Of the 86 participants, 30 used electronic devices 4-6 hours a day, 28 used electronic devices 6-8 hours, and 15 admitted to using electronic devices more than 8 hours a day.
- Most participants reported using electronic devices within 2 hours before bedtime (59 of 86).
- 62 of the participants reported they have sleeping problems at least some of the time.
- 35 participants reported occasional blue light protection usage and 14 reported consistent blue light protection usage.
- There were nine participants who reported consistent use of night mode on their phones. Four reported occasional difficulty sleeping and three reported consistent difficulty sleeping. When considering eye strain relief, seven of the night mode users reported relief at least some of the time.
- Only five participants reported consistent use of blue light blocking glasses. No significant improvement in sleepiness was reported. Four of the five reported some degree of eye strain relief.
- 24 participants reported they did not use electronic devices within two hours before bedtime. Of these participants, only four of them reported regularly having sleeping difficulties.
- A total of ten participants reported using electronic devices a total of 4 hours or less in a 24-hour period. Of these participants, six of them reported never having sleeping difficulties, and the other four said they only occasionally have sleeping difficulties.

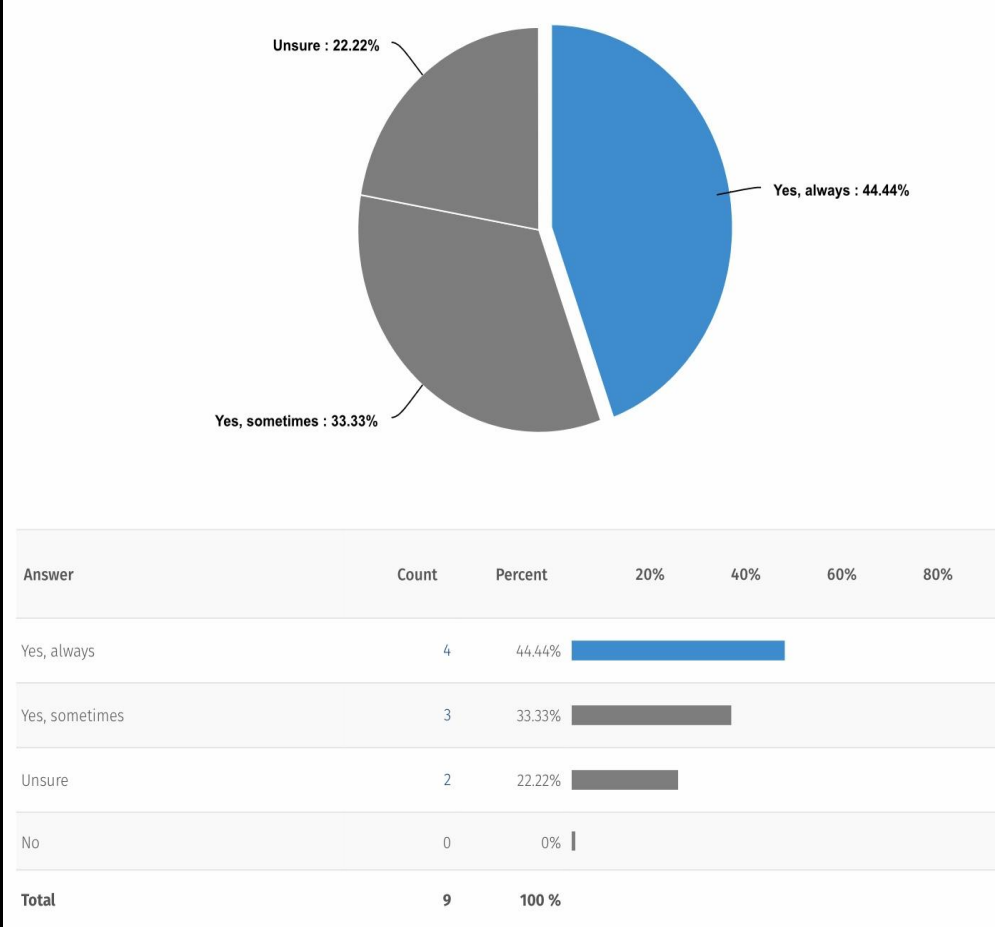


Figure 1. Reports of eye strain and headache relief among consistent use of night mode on electronic devices. A majority of participants reported some degree of relief.

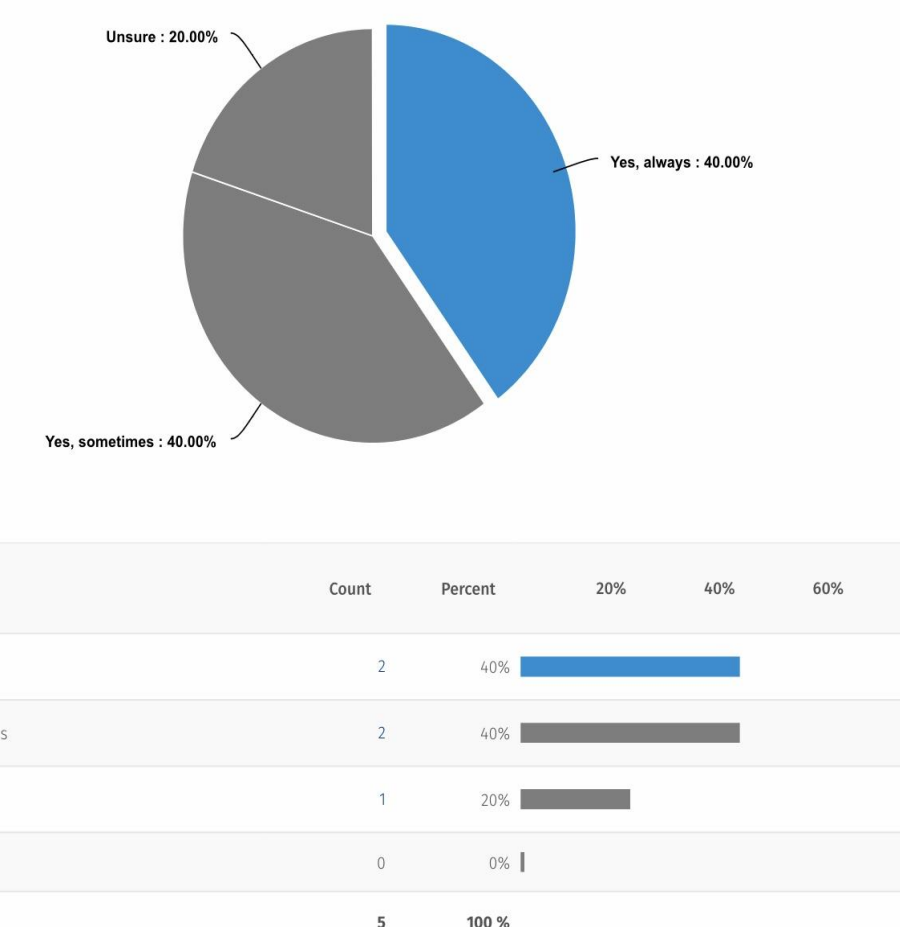


Figure 2. Reports of eye strain and headache relief among regular use of blue light glasses while using electronic devices. Most participants reported some degree of relief.

Conclusions

- The study did not find any significance between blue light protection and subjective responses to sleepiness.
- A majority of blue light protection users reported some degree of improvement in symptoms of eye strain and headaches.
- Reducing electronic device usage to no more than four hours a day and avoiding electronics at least two hours before bedtime subjectively result in optimal sleep patterns.
- The results of this study may inform eye care practitioners providing a solution to patients with difficulty sleeping and direct them to other solutions for eye strain rather than blue light blocking technology.

References

- Golebiowski B., et al. Smartphone Use and Effects on Tear Film, Blinking and Binocular Vision. *Current Eye Research*. 2020 Apr;45(4): 428-4342.
- Tosini G., Ferguson L., Tsubota K. Effects of Blue light on the circadian system and eye physiology. *Molecular Vision*. 2016 Jan 24;22:61-723.
- Alaimo A., et al. Toxicity of blue led light and A2E is associated to mitochondrial dynamics impairment in ARPE-19 cells: implications for age-related macular degeneration. *Archives of Toxicology*, 2019 May;93: 1401-14154.
- Ozkaya EK, Anderson G., Dhillon B., Bagnaninchi PO. Blue-light induced breakdown of barrier function on human retinal epithelial cells is mediated by PKC-ζ over-activation and oxidative stress. *Experimental Eye Research*, 2019 Dec; 189:1078175.
- Downie LE, et al. Analysis of a Systematic Review About Blue Light-Filtering Intraocular Lenses for Retinal Protection: Understanding the Limitations of the Evidence. *JAMA Ophthalmology*, 2019 Jun 1;137(6):694-6976.
- Rosenfield M., Li RT., Kirsch NT. A double-blind test of blue-blocking filters on symptoms of digital eye strain. *Work (Reading, Mass.)*, 2020;65(2):343-3487.
- Heo JY, et al. Effects of smartphone use with and without blue light at night in healthy adults: A randomized, double-blind, cross-over, placebo-controlled comparison. *Journal of Psychiatric Research* 2017 April; 87:61-70128.
- Mortazavi SAR, et al. Blocking Short-Wavelength Component of the Visible Light Emitted by Smartphones' Screens Improves Human Sleep Quality. *Journal of Biomedical Physics and Engineering*. 2018 Dec 1;8(4): 375-3809.
- Kimura M, Curzi ML., Romanowski CP. REM Sleep Alteration and Depression. *Archives Italiennes de biologie*10.
- Nagare, R., Plitnick, B., & Figueiro, M. (2018). Does the iPad Night Shift mode reduce melatonin suppression? *Lighting Research & Technology*, 51(3), 373-383.

Acknowledgements

- We would like to thank all FSU students who participated in our research survey.