

Illuminated Electronic Impact on Circadian Rhythm

Alertness for Learning vs. Blue Light/Laptop Use

By: The Dream Team

Rationale:

“Why I don’t I feel alert and ready for learning during the day at school anymore? What has changed?” We began asking these questions as we found ourselves tired and unable to concentrate during class time. We realized that the only significant variable that had changed in our environment was an initiative in our school toward a 1:1 technology ratio. Our district purchased 11” MacBook Air laptops for the benefit of the students, but we wondered, “Could there be disadvantages to the student use of this technology?” We know from personal experience that many students participate in after-school activities, which results in completing school assignments under the illumination of a laptop screen late at night. We discovered that the later we worked on our homework, the more difficult it was to focus on instruction the next day. “A computer or phone screen emit a blue light, and since blue lights have a higher frequency, it makes us more alert.” and this is not beneficial if we are preparing to go to sleep. This research helped us establish a suspected correlation between the screen use of technology, the release of melatonin and the ability to focus in school the following day. “Melatonin levels in the blood are high for about 12 hours until they become almost inactive again at about 9AM.” Could we be preventing that natural process? We suspected a correlation, but was there a causation? “With 96% of teens having at least one electronic item in their bedroom at night such as a TV, computer, or phone”, the impact of the answer to our questions would reach well beyond our classroom and into every classroom around the world.

Project Description:

In order to establish causation, our team needed to conduct both research and an investigation. While researching the topics of light and alertness, we learned that in humans, “light is the strongest synchronizing agent.” “Light and darkness are external signals that set the body’s biological clock,” better

known as the circadian rhythm. The circadian rhythm dictates that the body should start producing melatonin, a hormone that causes sleepiness, when it detects low frequency light. This low frequency light is detected by the human eye while the sun is setting each day. “Sunlight and other short wavelength light inhibits the production of melatonin.” In our research, we also learned about other light frequencies in the Electromagnetic Spectrum and its effect on the human circadian rhythm. When the circadian rhythm detects lights with a high frequency, such as the blue light emitted from electronic devices, it prevents the production of melatonin, thus preventing the body from falling into its natural resting state. “The loss of only one hour of sleep can accumulate over a long period of time and result in powerful negative effects of thinking, mood, and daytime performance.”

While researching, we developed a claim that high frequency blue light from electronic devices used after 8PM would interfere with a student’s alertness the following day. In order to support that claim, our team needed evidence. We surveyed 25 of our peers as potential participants in our research and selected ten. We evenly divided them into a control and an experimental group. In order to establish a base set of data, we surveyed all ten participants over the course of three days on their perceived alertness for learning. The survey consisted of different stages of academic alertness, ranging from feeling exhausted to feeling smart and alert. The feedback was collected using a similar rating scale to the pain assessment scales used in hospitals. Instead of representing pain, we changed the scale to represent alertness in school, with values and additional notations. Zero indicated the least alertness for learning, while ten represented the greatest. Everyone was surveyed at the beginning of the class period at approximately 10AM, a time in which melatonin should have naturally reduced to a point where the student was most alert, as discovered through our research. The average alertness in week one translated into the feeling, “Today is going to be a long day”. This was shown statistically with the control group’s raw score of 6.8, while the experimental group in the same week, averaged 6.7. The difference between the two groups initially resulted in only a 0.1 point gap. This demonstrates that both groups had similar outcomes from using electronics past 8pm.

The following week, the tested variable was changed. The experimental group was told not use any electronic device later than 8PM, because that is when the body starts producing melatonin. Neither group was informed of our claim to avoid study bias. In the second week, the raw score of the control group experienced a slight decrease from 6.8 to 6.2, a negative change of 0.6 points, a decreased level of alertness. Our experimental group's raw scores on alertness changed from 6.7 to 8.8, a significant increase of 2.1 points. On the survey, their responses changed from, "It's going to be a long day" to "Ready to Learn." Our initial claim through our collection of data provides the support that using technology after 8PM, significantly impacts academic awareness the subsequent day. We believe that the strength of our data more than supports our claim and suggests additional research is necessary.

Next Steps:

In order to add greater validity to the claim, more data is required over a longer period of time. While the data supported our claim, we would need a method of monitoring our experimental group. We would further like to authenticate our study to include a specific task rather than just casual feelings about alertness for learning. With additional data validating our claim, we would begin an awareness campaign in our school district. We would arrange a meeting with the Board of Education regarding the amount and effects of schoolwork beyond the school day including its benefits versus the consequences; we believe that the benefit of electronic assignments completed after 8PM does not warrant the costs of lost alertness in school the following day. It is our hope that this awareness will assist in creating new policies. While this would begin as a local campaign, we plan to use social media such as Snapchat, Twitter and Facebook to expand the reach of our research and educate others. By doing this, we hope to ensure that all students have the opportunity to learn and excel academically to the best of their abilities.

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