# Relationships between screen time and sleep duration: A research proposal

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PSYCH 250: Experimental Psychology

December 16th, 2020

**Abstract**

Sleep and technology have a demonstrable linkage which has been explored in sleep research, given the all-pervasiveness of technology in human life. Blue light that is emitted from screen-based devices is shown to interfere with sleep quality and duration (Jniene et al., 2019). This study seeks to examine the relationship between screen time and sleep duration. Five-hundred participants were administered a questionnaire asking about the approximate number of hours spent using electronic devices on average per day, and the approximate number of hours spent sleeping per day. Results are hypothesized to indicate a significant inverse relationship between screen time and sleep duration -- findings that would be in line with that of previous research on screen time and its relationship to sleep quality and duration. Further research is needed to examine whether these findings are informed by gender differences and age differences, extraneous variables, the compounded effect of multiple devices, and use changes over an extended period of time. In addition the exploration of quality of sleep (rather than quantity) could also prove worthwhile due to the implications this element has on sleep research, as well as the human body and psyche.

*Keywords*: sleep, sleep duration, screen time, blue light, devices, sleep quality

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The advent of technology has undoubtedly produced major changes in our daily lives. One area of our lives which has seen considerable change due to the influence of technology includes sleep (Jniene et al., 2019). According to previous literature conducted on medical students, blue light (which is emitted from devices like smartphones, tablets, and laptops) is shown to interfere with sleep quality and duration due to its melatonin-suppressing qualities -- 35.3% of the subjects reported poor sleep quality, and most attributed their sleep disturbances to this blue light and nighttime use (Jniene et al., 2019). This finding is also present in young children, where longer screen time was associated with shorter sleep duration (Magee et al., 2014). In a comprehensive literature review conducted by Hale and Guan, 90% of studies indicated shortened duration and delayed timing of sleep in school-aged children and adolescents (Hale & Guan, 2015). Cultural implications are present as well, with people identifying as Black or "Other" exhibiting greater smartphone screen time and less sleep duration (Christensen et al., 2016).

In our research, we aim to examine the relationship between hours of sleep and hours of screen time. We hypothesize that there will be a significant negative relationship between screen time and hours of sleep, with people spending more time using electronics and having shorter sleeping durations. This is because of the adverse effect that technology (specifically the blue light that technological devices emit) has on sleep quality and duration -- a finding that has been explored and replicated in most studies pertaining to this topic.

## Method

### Participants

Five-hundred participants will be systematically and randomly selected to participate in the study. Two-hundred and fifty males (50%) and females (50%) will be assessed. Participants of varying ages will be selected for the study. Participants will be sought out in the main square of Union Square.

**Materials**

A self-devised questionnaire about device use and sleep will be administered to the participants. The questionnaire will have two items, one of which will pertain to the approximate number of hours spent using a screen-based device per day (including TVs, laptops, cellphones, computers, or other devices), with the other corresponding to the approximate number of hours spent sleeping per night. A ratio scale-measurement for both questions will be used, where participants will be asked to bubble in how many hours of sleep they received and how many hours they spent using device, with hours ranging from “less than one” to “ten or more” (one hour, two hours, etc.) The questionnaire will only consist of these two questions. (Appendix).

**Procedure**

Participants will be randomly selected in front of the main square of Union Square, close to a designated train station entrance at about noon on a weekend. Every fifth person to walk out of the train station steps and onto the square will be approached and asked to complete a questionnaire. If they agree to participating in the study, they will be given the questionnaire. After filling out the questionnaire, results will be compiled and analyzed through JASP.

## Results

Participant means and standard deviations will be computed for the variables of hours of sleep and hours spent using electronic devices. In addition, a Pearson correlation will be computed for the variables of hours of sleep and hours of device use.

The Pearson correlation will test the relationship between hours of sleep and time spent using electronic devices (screen time). An inverse, negative relationship between hours of sleep and screen time is expected. As time spent using devices goes up, the amount of time one spends asleep is expected to go down. An observed relationship between these variables is theorized to exist. Thus, people who spend more time using electronics throughout the day are expected to sleep less.

## Discussion

Results are expected to show an inverse relationship between hours of sleep and hours spent using electronic devices. This would indicate a significant relationship between these two variables, pointing to the idea that people who spend more time using devices tend to sleep less.

Our expected results are in line with that of previous research. Research conducted by Jniene indicated that increased screen-time was associated with decreased sleep quality, efficiency, and duration in adults. Longer sleep onset was also observed. In addition, cultural differences and age differences were observed in the participants, with younger-adult participants and self-reporting Black and "Other" people reporting more smartphone screen time and less sleep (Christensen, et al., 2016). This discrepancy is theorized to be the result of socioeconomic differences by the researchers--racial minorities tend to have fewer computers at home and are more reliant on smartphones as a result (Christensen, et al., 2016). Thus, these findings are consistent with our own while elucidating another (racial/ethnic) element of research on the

connection between device-use and sleep patterns -- a different methodological approach than the one taken in our research.

Consistent with our expected findings, research conducted by Magee indicated that longer screen time (TV viewing in particular) was associated with lesser sleep duration in children (Magee et al., 2014). It is hypothesized that this is because of factors like sleep duration displacement. This hypothesis articulates the idea that longer screen time could hinder sleep-lending behaviors, such as physical activity -- thereby pointing to a third variable which may potentially account for sleep reduction. Consistent with the finding that blue light affects sleep, the researchers also hypothesized that sleep duration reduction may be related to the presence of artificial light, which in turn would impact circadian rhythms. The research brings up the important point of bidirectionality--given that less sleep could result in fatigue, the motivation to partake in less sleep-inducing behaviors (such as exercise) could arise from a desire to combat sleepiness with more media. Therefore, no causal relationship between screen time and sleep duration can be inferred, much like in our own research.

In research conducted by Jniene on medical students, results showed that out of the 97.3% of students used blue-light emitting devices at bedtime, 35.3% of them slept poorly -- with 65.7% of poor-sleepers attributing their disturbances to this nighttime usage (Jniene et al., 2019). Unhealthy sleep habits, such as higher duration of device-use at night, was linked to worse sleep quality. This finding explores another domain of sleep research that is not addressed in this study: sleep quality. Though sleep duration and sleep quality may be associated with one another, they are not synonymous. Thus, methodological differences that would lend themselves to different findings were present. The Pittsburgh Sleep Quality Index (PSQI) questionnaire was administered to determine sleep quality. In addition, sleep duration was also found to decrease

with increased screen time before bed -- the mean sleep duration was 6.3 hours in students that had sleep disturbances due to device-use at bedtime, as opposed to the 7.21 hours in those who did not. These findings are consistent with our own research, likely because of the melatonin-suppressing nature of blue light, which affects sleep quality and duration.

Research conducted by Parent indicated that screen time and sleep disturbances and duration were inversely related in children (Parent, et al., 2016). However, the facet of behavioral health was explored as well, showing that greater behavioral problems tended to exist in children and adolescents who exhibited greater sleep disturbance and device use. Issues like internalization, externalization, and peer problems tended to occur more frequently given the factor of higher youth screen time and greater sleep disturbances, regardless of the developmental period. Sleep duration, however, only seemed to link screen time to externalization in middle childhood. Though these findings explore the facets of behavior and quality rather than simply duration and screen time, they hold implications for the realm of psychology as a whole. Mental health and sleep quality are equally notable things to consider in sleep research. Thus, findings in this study support our own hypothesis that sleep duration is affected due to screen time. However, it is also worthwhile to consider the mental and behavioral effects that it has on individuals -- greater screen time is linked to less sleep and in turn to behavioral problems.

One possible limitation that arises is the inability to derive a causal effect from the research. Therefore, one is not able to conclude with certainty that increased screen time affects sleep duration -- there is merely an observed relationship between those two variables. An extraneous variable (such as lack of physical activity) may be affecting sleep duration. In addition, other variables apart from screen-time play into sleep-wake cycles as well, such as

Circadian rhythms, mood, energy level, and other factors. Thus, we cannot ensure that screen time has an impact on sleep duration. Another limitation of the study includes the fact that one cannot conflate hours of sleep with sleep quality. The two variables are not synonymous, as people have varying sleep durations and experience varying qualities of sleep -- an individual who gets very little sleep might still experience restedness. This idea has both personal and scientific implications, as sleeplessness, sleepiness and restedness might affect individuals differently. In future research, it would help to explore the variable of sleep quality to a greater extent. Lastly, some of the research looks at time spent on devices, but does not take into account the number of devices used, which could potentially make a difference in how it relates to sleep duration. Perhaps there is a compounded effect that is not being considered with the use of multiple devices (smartphones, tablets, computers, TV) in the relationship between screen time and sleep duration. We cannot properly gauge just how much devices affect sleep, or if they affect sleep at all -- let alone multiple devices.

Future research possibilities include a more substantial focus on the exploration of age and gender differences. Running statistical analyses on both genders would help to see if there is a meaningful difference between screen time and sleep duration between the groups. Because one group might exhibit longer device use and/or shorter sleep duration, it would be interesting to see if there is a distinction between males and females in these areas. The same could be done for the variable of age, where meaningful differences between age groups can be gleaned depending on elements like sleep duration and screen time in adults versus children, with children likely displaying greater screen time than adults. In addition, further research could explore the distinction between screen time in general and screen time that occurs at night, given that blue light may have the most effect on people during bedtime hours. One other thing that

would be important to explore would be the facet of sleep quality, rather than duration. Administering a questionnaire like the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality could determine whether screen time is related to sleep quality, because sleep duration does not necessarily suggest anything about quality. Quality is an important facet to assess in experimental research, because it has psychological and physical implications for the human being. A longitudinal design could also be helpful in understanding how screen time and resulting sleep patterns change over time, to determine if greater screen time over a period of time results in less sleep.

## References

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## Appendix

**Directions:** Please provide approximations about time spent using a device and time spent asleep. Bubble in the choice that best corresponds to your answer.

1. How many hours a day do you typically spend time using electronic devices? (Computers, laptops, cellphones, tablets, TVs, etc.)

❏ Less than one
❏ One
❏ Two
❏ Three
❏ Four
❏ Five
❏ Six
❏ Seven
❏ Eight
❏ Nine
❏ Ten or more

2. How many hours a day do you typically spend asleep?

❏ Less than one
❏ Two
❏ Three
❏ Four
❏ Five
❏ Six
❏ Seven
❏ Eight
❏ Nine
❏ Ten or more