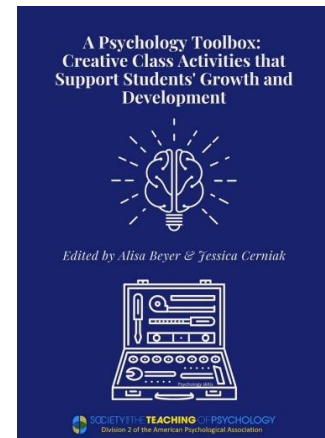


Counting Sheep and Counting the Consequences of Sleep Loss: Personal Reflection on How Losing Sleep Harms Your Competence

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Abstract (PsychINFO):

Based on clinical measures of disordered sleep and popular accounts of sleep by clinical experts, we created a reliable and valid Loss of Sleep Scale (LOSS) to describe everyday degrees of sleep deprivation students regularly experience. Factor analysis of 556 college students rating 50 statements about their sleep on a 7-point Likert scale revealed three subscales: an 8-item lack-of-adequate-sleep subscale ($\alpha=.825$), a 5-item not-a-morning-person subscale ($\alpha=.706$), and a 5-item drowsiness-while-awake subscale ($\alpha=.632$). A composite score correlated with each subscale and especially the first factor ($\alpha=.838$). The lack-of-adequate-sleep subscale was positively correlated with the total number of trips, bumps, drops, and spills over the last month, $r=.184$, $N=547$, $p<.001$. Similarly, the drowsiness-while-awake subscale correlated negatively to scores on a 'quiz' following short readings and a short delay, $r=-.176$, $N=339$, $p<.001$. We describe in detail an introductory psychology activity for understanding sleep loss embedding our measure within an online classroom-like learning experience. The Loss of Sleep Scale and the accompanying activity are freely available on the Copernican Revolution website (CopernicanRevolution.org), a project of the first author to spark self-reflection about psychology concepts by making them personally relevant. After completing any activity, persons receive a certificate of completion including their personalized results and a guide for interpretation. By combining our standard curriculum about sleep with personal reflection requiring little class-time, we can hopefully help students more deeply understand consciousness and grow personally from the experience.

Katie Hope Grobman

Associate Professor of Psychology
Department of Psychology
California State University – Monterey Bay
kgrobman@csumb.edu
[Copernican Revolution](http://CopernicanRevolution.org)

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Summary

By adding a short personal reflection activity to our standard introductory psychology curriculum about sleep, we can help students more deeply understand consciousness (APA Pillar 1) and contribute to their personal growth (APA Pillar 3). Based on clinical measures of sleep and popular accounts of sleep by clinical experts (APA Pillar 5), we created a reliable and valid Loss of Sleep Scale (LOSS) to describe everyday degrees of sleep deprivation students regularly experience. We embedded the LOSS within an online classroom-like experience where students see how their sleep loss impacts their learning (APA Pillar 3). The data provided to students about their experiences highlight impacts on physical health (APA Pillar 5). The literature review below provides examples to integrate into class discussion about larger impacts on both physical (e.g., workplace injuries) and mental health (e.g., depression, anxiety). We also provide examples of how sleep loss impacts learning, critical thinking, and creativity (APA Pillar 2). Though not the focus of our activity, a subscale measures individual differences (APA Pillar 4) between “night owls” and “early birds.” By bringing empirical data from students’ own experiences and personal reflection to the foreground, we help build understanding of how challenging it can be to recognize the causes of our behaviors. Our lesson simultaneously emphasizes Psychology’s reliance on empirical data as well as the imperfect personal lenses we bring to our experiences (APA Integrative Themes A and E).

Introduction

“Should I stay up an extra hour studying to ace the big test tomorrow?” Intuitively, students often answer yes. After all, whatever we’re studying, it’s instantly apparent how extra time seemingly yields extra knowledge or skills. Harder to see is what we’re losing when we lose sleep. With the following activity, students have an opportunity for self-reflection and to directly see what they’re losing from lack of sleep. We describe how the activity can be expanded or simplified into short semester-long homework assignments for more self-reflection or into a quick in-class activity. Finally, we summarize psychological research on the practical benefits of sleep we might share with students when discussing states of consciousness.

Sleep is both a standard Introductory Psychology topic when discussing abstract ideas of consciousness, and a concrete practical skill in students’ lives. Sleep is vital to our health, from avoiding physical ailments like weight gain (e.g., Shilsky et al. 2012) to psychological suffering like depression (e.g., Baglioni et al., 2016). Sleep loss leads to irritability, harming peer relationships (e.g., Gordon & Chen, 2014) and to a loss of focus, harming school performance (e.g., Dement & Vaughan, 1999). Yet sleep deprivation is tragically common as reported in single item survey questions of college students and adults. For example, a quarter of US adults report trouble falling or staying asleep most or every day in the last month and the rates of sleep loss are even higher for young adults, women, those without a college degree, and those earning less than the federal poverty line (Adjaye-Gbewonyo et al. 2022). A Gallup poll with a similar question suggested 40% of adults get less than 7 hours of sleep a night, and sleep deprivation was especially common among those with less income and those under 50 years old (Jones, 2013).

Understanding Sleep Loss Activity

Many clinical measures aid treatment and research of disorders of sleep (e.g., Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Stanford Sleepiness Scale, Groningen Sleep Quality Scale). Based on these measures, in addition to a popular book-based checklist meant to help self-identify sleep loss (e.g., Maas, 1998), we created a reliable and valid *Loss of Sleep Scale (LOSS)* to describe everyday degrees of sleep deprivation students regularly experience. Data presented here are from 556 students after excluding those who failed careful response checks. The sample was 85% female and 83% psychology majors, with 60% between 18 to 21 years old. The sample was ethnically diverse: 56% Hispanic, 31% White, 8% Asian, and 5% Black. Two (gender) by four (ethnicity) ANOVAs yielded neither significant main effects nor interactions (all $p > .2$). Due to multiple iterations in refining the activity, only 339 students completed the “quiz” portion described below.

Activity: Are You Sleep Deprived and Does it Really Matter for Your Learning?

The activity for understanding sleep loss embeds our measure within an online classroom-like learning experience taking most conscientious students less than 20 minutes (mean = 13.32 SD = 5.81). The LOSS and the accompanying activity are freely available on the [Copernican Revolution](#) website, a project of the first author to spark self-reflection about psychology concepts by making them personally relevant. After completing any activity, persons receive a certificate of completion including their personalized results and a guide for interpretation.

The activity begins by asking students simple questions about their sleep patterns in the last month, as well as their best guesses for how often they tripped, bumped into, spilled, or dropped something. Students then read five short paragraphs with a thought-provoking idea from five different disciplines (e.g., natural science, math, art, literature, and history). For example, based on Gombrich’s (1951) classic book, *The Story of Art*, we wrote:

Did Egyptians really “walk like an Egyptian” in that pose we find odd? No. Paintings are two dimensional, but the world has three dimensions, and it wasn’t until the Renaissance that artists figured out how to draw with linear perspective. The Egyptians came up with a clever way to make flat art represent a world with depth - show each body part from its most distinctive canonical perspective (e.g., “turn” hands so you can see all the fingers instead of drawing just the parts of fingers you can see).

Immediately following each paragraph was a simple multiple-choice item, for example:

The “walk like an Egyptian” pose was actually:

- A. The real way ancient Egyptians walked
- B. A special dance calling upon the Gods to help Egypt
- C. An artistic effort to represent a 3D world in 2D
- D. Entirely make up by the 80’s band, The Bangles, with no connection to reality

Students overwhelmingly answered these questions correctly (mean = 86.17%, SD = 24.21%). After reading and answering questions, students responded to 50 statements about their sleep on a 7-point Likert scale (LOSS). Factor analysis without rotation revealed three subscales: an 8-item lack-of-adequate-sleep subscale ($\alpha=.825$), a 5-item not-a-morning-person subscale ($\alpha=.706$), and a 5-item drowsiness-while-awake subscale ($\alpha=.632$). A composite score correlated with each subscale and especially the first factor ($\alpha=.838$). See Appendix A for the complete measure.

Finally, students were asked to read five multiple choice questions and take their best guess for each without looking up answers. The answer to each question was embedded within each of the earlier paragraphs. For example:

- When did artists first figure out how to represent our three-dimensional world with linear perspective in two-dimensional art?
- A. In Ancient Egypt (around 3000 BCE)
 - B. During the Iron Age as Ancient Israel reached its Golden Age (around 1000 BCE)
 - C. During the Renaissance in Italy (around 1400 AD)
 - D. Within Ukiyo-e Japanese Art (around 1700 AD)
 - E. Actually artists never struggled to represent our 3D world in 2D

Though students were forewarned about additional questions after the survey, students found the post-survey-test much more challenging (mean = 44.23% SD = 28.50%). Nevertheless, they performed above chance of 17.5%, $t(338)=28.467, p < .001$.

Students’ certificates of completion include their three subscale scores, composite score, and percent correct for quizzes. The guide for interpretation includes normative data, everyday language to aide understanding numbers (e.g., “some sleep loss”), and descriptions of relationships between variables in both statistical and everyday language. The guide also helps students to consider the implications of their scores as well as providing them with tips for improving sleep.

Table 1 provides a summary of the lack-of-adequate-sleep subscale which is positively correlated with the total number of trips, bumps, drops, and spills over the last month, $r=.184, N=547, p<.001$. Similarly, the drowsiness-while-awake subscale correlates negatively with quiz grade, $r=-.176, N=339, p<.001$. That is, those with little sleep loss scored about 49% on the post-survey quiz, those with some sleep loss scored 45% (8% lower), and those with severe sleep loss scored 39% (22% worse). The results are nearly identical for the post-survey quiz among students scoring perfectly on the pre-survey questions with the paragraphs, $r=-.165, N=288, p=.005$. There are concrete consequences to loss of sleep.

Table 1. Lack of adequate sleep subscale descriptors

Score Range	Sleep Loss Description	Typical Sleep on School/Work Night	Weekend Extra Sleep	Drop, Spill, Trip, & Bump
1.00 to 3.00	Little	≈ 7.5 hr.	≈ 1 hr. daily	Once every 3 to 4 days (people vary for reasons other than sleep, so your “best”)
3.00 to 5.00	Some	≈ 6.5 hr.	≈ 2 hr. daily	Once every 2 days (50% more often)
5.00 to 7.00	Severe	< 6 hr.	> 2.5 hr. daily	Once every day (more than double with adequate sleep).

Variations on the Activity

We recommend the full online activity, including the paragraphs and “quiz” for students to have the full experience of directly observing how their attention and learning could be impacted. An online version of the 18-item LOSS is also available on [Copernican Revolution](#) if you would like them to

complete an especially quick homework assignment. In contrast, after having done the full activity, you might ask students to complete the 18-item version once a month, and to reflect on how they're improving their sleep habits or why they may be struggling to do so. To minimize the need for internet access, we also prepared a [handout with the 8 item lack-of-adequate-sleep LOSS subscale](#) for self-scoring during class, with its reverse side offering tips for improving sleep.

Sleep and Performance - Empirical Findings

Naturalistic correlational studies suggest children and adolescents with poorer sleep quality perform worse in school (e.g., Dewald et al., 2010). Similarly, among Introductory Psychology students carrying a full course load, those reporting lower sleep quality earned lower course grades (Howell et al., 2004). Medical school students with poorer sleep quality prior to the board exam performed worse on it (Ahrberg et al. 2012). A longitudinal SEM model with thousands of college students suggested those with chronic sleep deprivation from their freshman to senior year earned lower GPA's and were less likely to graduate even when controlling for many possible confounding health-related factors (Chen & Chen, 2019).

Experimental interventions suggest improving sleep causes improved performance across a wide range of ages and outcomes. Older children allowed only five hours of sleep one night performed worse on measures of creativity and abstract thinking (Randazzo et al., 1998). Similarly, college students kept up 24 hours performed worse on critical thinking tasks and – perhaps most importantly to emphasize to our students – the sleep-deprived participants were unaware of their own cognitive impairment (Pilcher & Walters, 1997). Interventions to improve sleep in adults led to improved mental health, such as reducing symptoms of depression and anxiety (Scott et al., 2021).

Some of the most interesting studies to share with students are quasi-experiments making real-world implications apparent and suggesting causality. Annual shifts between daylight savings time and standard time provide us a chance to see what happens when the population loses or gains an hour of sleep Monday morning. Traffic accidents generally, and fatal car accidents specifically, rise with a lost hour of sleep and fall with a gained hour of sleep (Varughese & Allen, 2001). When a county chose to begin school an hour later, high school students reported more sleep on school nights and less catch-up sleep on weekends. Moreover, the teen car crash rate dropped 16.5% (Danner & Phillips, 2008). Quasi-experimental findings are not limited to car accidents; workplace injury rates similarly rise and fall on Monday with a loss or gain of an hour of sleep (Barnes & Wagner, 2009).

Students' Immediate Qualitative Reactions

Students' reactions varied widely in anonymous qualitative feedback. Many students found it informative and interesting. In their feedback, many students compared and contrasted their results with their belief about their sleep quality; most saw the results as validating what they suspected, but some wrote of finding it disconcerting to realize they are not getting adequate sleep. A number of students expressed frustration at needing to score by hand, so we recommend the online variation of the activity unless you would specifically like students to discuss their immediate reactions during class (e.g., in small groups). It may be useful for students to compute by hand to learn more about psychometrics (e.g., reverse-scoring). A common frustration expressed was, "I had no idea how to estimate" on the item asking about bumps, trips, spills, and drops. Yet this was also the biggest source of surprise for students. While some were arbitrarily guessing three to five occurrences, others were similarly arbitrarily guessing 30 to 50 occurrences.

The activity provides no anchor for estimation, and many came to the realization they may be especially likely to experience mishaps due to their lack of quality sleep!

Many students wrote about their newfound motivation to improve their sleep. This is by design. Contrary to common sense, trying to persuade someone with dramatically strong fear appeals (e.g., fatal car accidents) is not nearly as persuasive at altering behavior than softer fear appeals (e.g., tripping) (e.g., Janis & Feshbach, 1953). Moreover, when you couple a fear appeal with concrete steps, people are more likely to change their behavior (e.g., tips to improve sleep quality) (e.g., Leventhal et al., 1967). In fact, I (first author) plan to try the 8-item handout version during a Social Psychology class to illustrate how we can apply classic psychological research on fear with persuasion.

Conclusion: Connecting Our Obliviousness about Sleep Loss with Other Psychological Phenomena

“Should I stay up an extra hour studying to ace the big test tomorrow?” No matter the outcome of the test, we can easily miss the role sleep plays, as aforementioned experimental research illustrates (Pilcher & Walters, 1997). But our obliviousness is not unique to sleep and here we have an opportunity to bring up connections across the Introductory Psychology curriculum. Decades of research across widely varied psychological phenomena - as summarized in one of the most cited meta-analyses - illustrates we simply do not know the causes of our own behavior (Nisbett & Wilson, 1977). Indeed, many of us begin our introductory psychology classes with the failed historical scientific effort of Structuralism. It’s a common-sense approach to psychology; while adults know introspection is not perfect, they overwhelmingly believe theirs is accurate (e.g., Kozuch & Nichols, 2010).

Wrap Up

- This activity helps bring one of our misconceptions to our attention. Moreover, introspection does have value. Personal reflection makes concepts real for us, focuses our depth-of-processing, and consequently dramatically improves our learning (e.g., Hyde & Jenkins, 1969).
- We designed this activity with the importance of connecting personal reflection to psychology in mind. By combining our standard curriculum about sleep with personal reflection requiring little class-time, we can hopefully help students more deeply understand consciousness and grow personally from the experience.
- The Loss of Sleep Scale and the accompanying activity are freely available on the Copernican Revolution website (CopernicanRevolution.org), a project of the first author to spark self-reflection about psychology concepts by making them personally relevant. After completing any activity, persons receive a certificate of completion including their personalized results and a guide for interpretation.



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Authors Contact Information

Katie Hope Grobman, BS Physics, MS Philosophy, PhD Psychology

Associate Professor of Psychology
Department of Psychology
California State University – Monterey Bay
kgrobman@csumb.edu
[Copernican Revolution](#)

Navid Amarlou, BSc Biology

Undergraduate Student
Department of Psychology
California State University – Monterey Bay
namarlou@csumb.edu

Appendix A. Loss of Sleep Scale (LOSS)

Please rate the extent to which you agree or disagree with each of the following statements when thinking about your experiences over about the ***past month***.

- | | | | | | | |
|----------------------|----------|----------------------|----------------------------------|-------------------|-------|-------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| strongly
disagree | disagree | somewhat
disagree | neither
disagree
nor agree | somewhat
agree | agree | strongly
agree |

- a1. I don't get enough sleep most nights.
- a2. I sleep well most nights.
- a3. I feel woozy, like I'm fighting to stay awake, during the day.
- a4. I feel active, vital, and awake most of the day.
- a5. I feel rested after waking up in the morning
- a6. I have trouble concentrating on important tasks.
- a7. I find myself yawning throughout the day.
- a8. I go to sleep about the same time every night.
- b1. Most mornings I'd be up on time even if I didn't have an alarm.
- b2. When I don't have to get up the next morning, I sleep for an especially long time.
- b3. I need an alarm clock in order to wake up on time.
- b4. I hit snooze to get more sleep weekday mornings.
- b5. I wake up about the same time every morning.
- c1. I doze off while sitting quietly in public places (e.g., park bench, class)
- c2. I doze off when I'm trying to read.
- c3. I need to nap to get through the day.
- c4. I fall asleep in warm rooms.
- c5. I doze off when I'm watching videos.

Scoring. Items were randomly ordered for each student. Reverse-score items a2, a4, a5, b1, & b5. Average all items for the composite score and a, b, & c items separately for lack-of-adequate sleep (factor 1), not-a-morning-person (factor 2), and drowsiness-while-awake (factor 3) subscales.

Normative Data. Based on 557 undergraduate students. No main effects of ethnicity or gender.

LOSS Scale	Mean	Standard Deviation
lack-of-adequate sleep (factor 1)	4.249	1.116
not-a-morning-person (factor 2)	4.794	1.212
drowsiness-while-awake (factor 3)	4.061	1.157
composite LOSS	4.348	0.899

Author's Note: The appendix is not included in the original publication except as a linked document. I added it here for your convenience. The latest version of this activity is available at <https://CopernicanRevolution.org/>