

FAB 9 Study Sheet #3 – Sleep

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Topic 3: No sleep, no learning

Sleep is another factor in long-term memory formation. It is an area I became interested in because of something bizarre that happened in one of my English classes. It was a first-year English class in a Japanese university, one with a rather low ranking. Japanese have the stereotype of being serious, dedicated students, but this is generally a fiction, especially at the university level. In fact, one study found that Japanese high school students spend far less time on homework than Chinese and even a bit less than Americans. So even though the students in this class were English majors, they were not motivated to study outside class. Getting them to truly learn things was difficult, so one day, I decided to spend the entire class teaching one particular structure, present perfect tense for relating experiences, and make sure it was fully internalized. The one single question form, "Have you ever," and how to answer it was explained, modeled, practiced, used in communicative interactions, and tested for mastery throughout. It was a perfect lesson and I was sure everyone got it.

How surprised I was a few hours later when one of the students who had previously demonstrated mastery could not even understand the simple "Have you ever" question I asked her. Worse, she did not even remember that we had studied it, even though part of her practicing was done with me as a partner. I was shocked, and it was not just her. Most of the other students seemed to have forgotten this expression a week later as well. Now I have the deepest respect for learning loss, but this seemed bizarre. Then, I discovered what the probable reason was. The students who had forgotten the lesson were doing night jobs and hardly getting any sleep. No sleep, no memory.

Lack of sleep might be the single greatest problem in education. The National Sleep Foundation found that only 20% of American adolescents get an optimal amount of sleep, 9 hours or more, and only 51% get even eight hours (2006). How does this affect performance? Research shows that an all-A student who gets a little less than seven hours sleep on weeknights and a little more than seven on weekends will drop from the top 10% of her class to the bottom 9% of those not sleep deprived (Medina, 2008, p. 162). With a few all-nighters, she will start showing the same symptoms as someone with Alzheimer's. Another study shows that only six hours of sleep for five nights in a row leads to 60% loss in performance. 60%! Dr. John Medina, author of *Brain Rules*, puts it simply: "Sleep loss means mind loss" (p. 162). This is true for us as well. If you have trouble remembering things these days, it is probably because of sleep deterioration, not brain deterioration. Although it is almost impossible for most adults to sleep eight hours, even if they have the time, we still need eight hours for full memory consolidation.

Of course, we have long known that sleep is important for learning, but neuroscience tells us why. We tend to think of sleep as a time our brains are at rest, but brain studies have found that in certain stages our brains are even more active than when we are awake. This is because our brains reactivate the neural connections of new learning to consolidate that learning into memory. According to Penny Lewis, in the slow-wave stage, the deepest kind of sleep, our neurons start firing in synchronous bursts and the level of acetylcholine drops precipitously (Campbell, 2014). Acetylcholine is a neurotransmitter that blocks communication between the hippocampus, where new learning is stored, and the neocortex, where new memories are integrated into older ones. So its drop allows these two structures to communicate. We believe that the slow-wave stage is when new memories are passed to the

neocortex. Research also suggests that we shed memories of lesser importance during this stage as well.

Then, we go into the REM stage and the amount of acetylcholine quadruples (Campbell, 2014). Communication with the hippocampus shuts down (which is why we rarely remember dreams). We believe that during the REM stage, the neocortex scans existing memory for association with the new memory and links them up. Maybe that is why we have such vivid and disjointed dreams during that stage. The linking involves a lot of sanding and reshaping too. Rather than our storing each memory as separate and exact in this stage, we make associations between whole sets of memories and extract generalities out of them. Related memories meld to create understanding. (Did you catch my spaced repetition?)

The slow-wave to REM cycle repeats throughout the night, from four to six times (Irwin, 2015). Getting less sleep, or poor sleep, reduces the number of cycles and thus impairs memory formation. Considering all the enemies of sleep our youth face – computers, caffeine, blue light, and even the shift of circadian rhythm that happens in teens – we should consider sleep a serious educational issue. Teachers need to be telling students the importance of sleep, saying that one hour of sleep equals an hour of study. Even naps as short as six minutes help (Campbell, 2014) Administrators need to look into setting later starting times, which have been repeatedly shown to increase achievement. And all of you reading this chapter need to get a good night's sleep to remember it.

Campbell, G., (2014, March 28). Interview with Penny Lewis, PhD, author of *The Secret World of Sleep: The Surprising Science of the Mind at Rest*. Brain Science Podcast transcript, Episode 107. Originally aired 03/18/2014. Retrieved from <http://brainsciencepodcast.libsyn.com/podcast>

Irwin, M. R. (2015). Why sleep is important for health: a psychoneuroimmunology perspective. *Psychology*, 66(1), 143.

National Sleep Foundation, (2006). 2006 Teens and Sleep Poll. Retrieved from <https://sleepfoundation.org/sleep-polls-data/sleep-in-america-poll/2006-teens-and-sleep>