

Research Question: How does sleep deprivation affect memory retention rate in adolescents?

Adolescents are at the stage in life where humans develop significantly. Their brains are actively developing and constantly learning and with everything occurring, sleep is a good way for them to recover. However, many adolescents are too busy doing other activities that prevent them from having proper sleep time. Since sleep is undeniably essential for adolescents, what happens to remembrance when they get an inadequate amount of sleep? For something to become a memory, three functions must occur: acquisition, consolidation, and recall. Although acquisition and recall occur when we are awake, memory consolidation, which is when a memory becomes stable in the brain, can only occur when people are asleep. So what happens to the memory retention rate of children who experience a lack of sleep? There are various experiments that have explored this question, and have concluded that when adolescents are sleep-deprived, their memory retention rate worsens.

There is plenty of evidence to show that sleep allows newly obtained memories to consolidate better in adults. However, very little is known about how sleep affects adolescents. Fortunately, Cousins, Sasmita, and Chee conducted an experiment that measured memory retention after multiple nights of sleep deprivation. After further examination, they discovered that children who were sleep deprived had more difficulty encoding a picture into their long-term memory compared to adolescents who had the opportunity to sleep for the recommended amount. Cousins et al. (2017) also suggested that successive nights of sleep deprivation causes a “deficit in the ability to effectively encode new information.” The scientists found that the ineffective encoding may have been caused by hippocampal damage due to sleep loss. This demonstrates that sleep loss doesn’t only affect memory, but also physical aspects in the brain.

To add on, Cousins, Chee, and Wong conducted another similar experiment in 2019 that studied how multiple nights of sleep loss impairs long term memory retention in adolescents. Instead of asking students to encode a picture into their memory, this time the experiment simulated a school day. Adolescents were asked to learn detailed facts about different species of arthropod and then were tested; some were sleep restricted and others had full rest. After testing the two groups Cousins et al., (2019) concluded that “long-term retention of classroom

material is significantly compromised when adolescents learn after being sleep deprived," a similar conclusion to what Cousins and Chee made in their previous experiment.

An experiment conducted by Steenari et al. (2010) studied the association between sleep quantity/quality and performance in auditory/visual working memory tasks. Working memory is a temporary storage that holds incoming, task-relevant information and integrates it with other information from long-term memory. This experiment had many similar findings as the other experiment; in which when examining patients they found people who sleep less were more likely to respond incorrectly. However, a key difference is when Steenari et al. (2010) mentioned "sleep efficiency and its association with a higher percentage of incorrect responses in working memory tasks," which suggests that in assessing sleep, attention should also be directed to the sleep quality.

So far, experiments have only shown results when children get insufficient sleep. However to fully answer the question, "how does sleep deprivation affect memory retention rate in adolescents," we must also take a look at what happens when adolescents do get enough sleep. An experiment conducted by Wilhelm, Diekelmann, and Born elaborates that children sleeping improves memory performance on declarative but not procedural tasks. Declarative memories are the conscious recollection of events, and information used in everyday living, while procedural memories store information on how to perform procedures, such as walking, and riding a bike. To note, in this experiment, different tasks were done to measure the two types of memories; for example the declarative memory was tested using a word-pair associate learning task, while procedural memory was tested by a finger sequence tapping task. Wilhelm et al. (2008) found that "on the word-pair association task, both children and adults retention of word-pairs across the sleep interval was better than across the wake interval." This shows that due to the children sleeping, they were able to remember things better, proving that sleep to some extent does help memory. Overall this demonstrates that sleep reinforces declarative memories. When adolescents are sleep deprived, they will have difficulty recalling events and information, which is what the other experiments similarly demonstrated.

To summarize, sleep deprivation in adolescents increasingly worsens memory retention rate. Although sleep doesn't effectively improve procedural memory recall, it does in fact improve declarative memory recall. All in all there is sufficient evidence to prove that sleep deprivation results in children having difficulty recalling information.

In the future, I plan to do further research on what are other factors that are causing children to do poorly in school. While researching my current question I discovered a lot of

information supporting that memory has a huge affect on the grades students get in school. After reading that, I came to the realization that there have to be other factors affecting students' grades; it can't only be memory. Students need all the help they can get, and I plan to further educate people that it may not be entirely the students' fault for their poor grades. Once we figure out the factors that are preventing students from excelling we can then find ways to help them.

Work Cited

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