**Analyses of the Sleep Habits of High School Students in the Net Generation**

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**Personal Background:**

My personal interest for sleep began in 9th grade, after browsing the library looking for a book on psychology, which I had grown interested in. Passing by the sleep section, I noticed books that caught my eye such as “Sleep Disorders” and “Parasomnias”, but I decided to start from the basics of sleep, and in doing so, have studied the works of Dement, Carskadon, and many others.

 Learning more about sleep, I grew increasingly concerned at the lack of awareness available in the community, and have been doing all that I can to help those around me and bring a change about in the world. For example, many cases of sleep apnea where victims suddenly stop breathing are undertreated and underdiagnosed. Furthermore, since sleep is such a big part of our lives, it impacts many things, such as our diet, health, even our relationships. High school sleep problems are also prevalent because of the stressful environment that presents itself during this time, and especially because so little awareness of this “elephant in the room” is publicized. In order to do make others more aware, I have tried to focus on publicity by spreading awareness through my own work.

So far, I have completed two original research experiments, and am working on another. One focuses on teenage sleep deprivation and sleep disorders, and have set up a sleep education program to educate teenagers about sleep and how key its function is. The other is the comprehensive sleep study which sets to analyze trends of high school students and sleep, which is further described in this paper. Finally, I have studied the body under sleep, specifically the pelvic floor. Under guidance from USC, I have worked alongside a professor to discover the muscle tone of the pelvic floor during sleep, and how it may affect disorders such as nocturnal enuresis or nocturia.

**Introduction:**

For a long time, sleep has been a subject that has been eluded by many scientists, and has only been studied relatively in depth by few. The concept of sleep is very mysterious, and even after years of research after the subject formally became a science through the pioneer Dr. William Dement, who eventually became known as the “Father of Sleep”. Since then, his legacy has been continued by many different scientists in the area. However, the study of sleep is still severely lacking in regards to teenagers, especially in the United States. While it has been promoted more extensively in countries such as New Zealand and Australia where later start times are prevalent, it has not been as widespread.

 For example, there is a lack of exposure in California. Even in the state mandated health curriculum, extensive parts about sleep are missing, although as humans, sleep consumes around 1/3rd of our life. While there is notification of sexual activity and/or sexually transmitted diseases, family life, and diet, there is very little discussion about sleep and its importance. Perhaps, this disparity seems a bit odd, considering that sleeping encompasses a vital part of our routine. Even if it does not make it to state curriculum, school/ school districts could relatively implement through a pamphlet/handout that would be very simple to create, and based off the National Sleep Foundation/National Institutes of Health.

 Though the question of why we sleep and many others like it have not been answered, it does not reduce the importance of the rest we need. In fact, it makes it all the more important. Due to the ambiguity of sleep, new solutions have constantly presented itself as substitutes for lengthy, quality sleep, in order to achieve the same positive effects of sleep, whether that may be brain enhancement drugs such as nootropics or stimulants to help us focus such as Adderall ™. Other machines have also found a niche, such as Cranial Electrotherapy Stimulation (CES) and other devices. With the independence that many of us have, one of the key stages where quality intervention is in high school.

Since high school is a period of time where parents can still exercise control but the individual has more of a decision in what they can do, intervention at this stage is key. Plus, since high school students, would most typically be under 18, prescription drugs and other types of drugs would be less accessible. Habits are important to change between high school and college to ensure quality health and success.

Seeing this lack in education in not only state curriculum but also general knowledge amongst teenagers, I set to bridge this gap by starting a sleep education program and also conducting a sleep survey distributed to over 900 students. While the response rate was relatively low given its comprehensive quality, the data that has been collected could still be relatively useful in promoting the goals of interest groups as well as for implementing new state curriculum.

**Data Collection:**

A comprehensive survey asking questions about social, physical, and mental health was distributed among 900 students in the Orange County, Artesia/Bellflower/Cerritos (ABCUSD), and Fullerton area. The survey was given out through a link, which directed to a Google ™ Form. The preliminary questions did a simple background check, and asked the age, name, and grade of the student, along with other demographics that made the later data easier to analyze. Questions about family were also asked, and so was income in order to specify what certain income range we were analyzing. The entire questionnaire consisted of around 60 questions, a mixture of both free responses and multiple choice.

Social based questions including asking about social media platforms/messengers, and the frequency of use, and if sleep would affect the way they would act on these platforms. Physical based questions asked about how they felt throughout the day, and whether they believed their athletic performance was hindered or improved because of sleep. Finally, mental based questions asked about how they felt they performed at school under specific quantities of sleep. For example, a question would ask how they felt they performed after performing an all-nighter compared to get a normal and fitful night’s rest. General questions asked them the type of bed they slept on, asked them to describe their sleep environment, and the duration of a normal night’s sleep for them.

The survey was mostly completed in March 2014, and was left live, but no further responses have been recorded as of April 2014.

**Analyses:**

**Minutes it Takes to Fall Asleep vs Grade Point Average (GPA):** While analyzing the results from my sleep survey, I compared the time it takes to fall asleep and its effect on GPA. After finding some quality correlations, the following graph was presented.



As you can see, the GPA of students drops in a downward trend the longer it takes the student to fall asleep. There can be several reasons for this, and the primary one is insomnia.

 Insomnia is the inability to sleep or staying asleep throughout the night, and most often times can be caused by stress or anxiety. For some, the insomnia can be periodic or chronic. In teenagers, stress and anxiety can be caused by increased workload and relationships. Proven by a study by the British Psychological Society[[1]](#footnote-1), teenage insomnia can lead to depression and increased anxiety disorders, which can eventually open up doors to drug and alcohol misuse.

 In the case that it is not insomnia, prevalent mobile devices can also prolong the amount of time it takes to sleep. Since this question was asked by a measure of the time entering the bed to the time they fell asleep, staying on their mobile devices whie they are in bed is also a factor in keeping them awake. The blue light that most devices emit can keep one’s mind awake and alert, which can be prohibitive and counterproductive when one is trying to sleep. Also, time at the computer, which is a large source of blue light could keep the mind working longer than it needs to.

 When it comes to the GPA factor, there are many things that could be weighing in on the reason why there is a lower GPA when it takes longer to fall asleep. Primarily, the student could feel much less rested. Considering 30-45 minutes is an entire sleep cycle, not only is REM Sleep lost, where memory consolidation happens, but so is sleep in stages 3 and 4, which is considered to be deep sleep, and the most crucial part of sleeping in order to feel restful. Interrupting a sleep cycle in these stages can lead to grogginess when feeling awake. Because the student does not feel well rested enough, mental performance can be hindered during school hours. Because the student doesn’t feel awake, the mental performance they have that day will not be in its prime, and can thus lead to slipping grades in the class. Moreover, the lost sleep translates into a later bedtime, and because there are less amount of sleep cycles to consolidate memory, the material they have been studying won’t be retained as well in their mind. This is crucial because tests can make up a majority of the points in a class, and can be a large factor on GPA. For example, staying up for an hour or more when the test is the next day will be detrimental, especially in the earlier classes when the mind is not yet completely awake and processing to do the best it can.

 All in all, the longer it takes for a student to sleep can correlate to a lower GPA. Not only is this possibly caused by sleep disorders such as insomnia, it can also be caused my mobile devices which keep the student awake at night longer. Possible solutions to this would be to get treated for insomnia, and use less blue light later into the night, either by using specific screen protectors or download blue blocking light programs such as F.lux. Blue blocking lenses may also be helpful in the sleeping area in order to reduce the amount of light that enters the area.

**Listening to Music vs GPA:**

It has been proven through several studies that classical music can help a student focus when studying, but what about the genre and quantity of music that the students listens to? While analyzing the results, a majority of the students listened to pop, but there was no solid correlation to prove that pop meant higher GPA, or that a certain genre led to a higher GPA.

 However, what did stand out from the research done was that students that listened to music less, and typically briefly listening to music before going to bed tended to have a higher GPA. What was also in common with these students was that they would listen to classical music.

 While this research is clearly preliminary, music is very powerful for the brain. Naturally, our brains receive music well because our ears perceive it as harmonious. Perhaps, the genre of classical music has much more powerful qualities than just focus, and may help boost GPA, especially when listened to right before bed. The length of music listening was generally small.

 Another reason for lower GPAs for those that listen to more music may be that it distracts them from their work, and typically takes longer to accomplish a task they could do without music, but the exact opposite can also be said since some prefer to listen to music and are much more efficient when they hear music. With that being said, music is a preference. However, why does classical music stand out so much then in its efficacy in boosting mental performance and sleep?

 This is a question that has not been fully discovered yet, and I hope that future research may study these correlations. I find that this correlation could perhaps be very interesting because of the soothing effects it has on the brain. Past research has been done on this, but it is not extensive enough yet to draw full conclusions, and the study conducted were on adults ranging from ages 19-28, and usually in college, while this study focuses primarily on high school students.

 Already, a remedy for coping with an inability to sleep is to listen to calming sounds, such as raindrops falling or waterfall. Perhaps the way classical music is conducted, with all its facets, is efficient in telling the brain to “turn off” and prompts the release of neurotransmitters that eventually start powering down the brain. There clearly exists a difference between genres, and more research needs to be done on the usefulness of classical music and its aid in helping those sleep. Not only would be able to foment sleep, it may be more restful sleep. High GPAs could be the sign of this, an offshoot of the Mozart effect. The Mozart effect was a conclusion made in which a study done was linking Mozart’s music to generally higher IQ people that listened to it as they grew older. The missing link between GPA, sleep, and music still lies unknown.

**Use of Sleeping Aids vs GPA**

Looking at further results, we can find that those who require sleeping aids tend to have lower GPAs. What could be the reason of this? One very plausible reason is that by naturally having trouble sleeping, their GPA will be lower. As stated earlier, trouble falling asleep could lead to lost sleep cycles, and eventually less wakefulness throughout the day.

 However, a majority of students did not rely on any sort of sleeping aids but reported to be sleepy throughout the day. The use of sleeping aids is not inherently bad. In fact, it has been steadily rising as our society becomes more technologically advanced, in comparison to the past, but still has not been utilized because so little people realize that their sleep is “unhealthy”. With the ubiquitous amount of blue light around us, many people have trouble sleeping. Furthermore, since our society places so little stress on the importance of sleep, many have come to consider it as unimportant, not realizing how many factors it impacts. Healthy sleep aids include sleeping mats, which target certain pressure points in the body sort of like external acupuncture, and can help relieve stiff muscles and release stress. Other sleep aids include blue blocking lenses which are glasses that are made to block out blue light and present a dimmer wavelength that promotes sleep, such as yellow light. Oftentimes, certain types of music can also help well with promoting sleep. Home remedies like putting an onion beside your bed or drinking a warm glass of milk or tea are also used.

 If needed, melatonin supplements are also available. Melatonin is a hormone released by the piteal gland in charge of our sleep-wake cycles. These melatonin supplements are used to induce sleep and can reset the sleep wake cycle of a person. Another method of healthy sleep therapy and aid is through light therapy. Light therapy is used by completely blocking out light in order to attain complete, or near complete darkness. The lack of light combined with melatonin, if necessary, can reset the circadian rhythm of a person. After the circadian rhythm is set, measures need to be taken to achieve the bed time necessary. As this routine becomes a habit, the sleep pressure at the time will naturally rise, and your body will learn to grow tired at that specific time. In order to wake, all of the light needs to be let in, since in the presence of light, melatonin production is reduced significantly. When the light is let in, the person feels more awake and refreshed, and wake up times can also be trained by repeatedly doing this process.

 Some sleeping aids, or substitutes are harmful. For example, biohacking, which typically involves promoting maximum performance when sleeping very little can have long term consequences when done recklessly and incorrectly. Also, substitutes for sleep, which arise in the form of brain enhancing drugs, nootropics, and Central Nervous System stimulants, or “uppers” to get more focus and alertness are often damaging to the body, especially when used without reason. More and more high school students find themselves using Adderall ™ and similar drugs in order to achieve focus, especially during important finals and standardized testing. Not only is this unfair, but the student’s health can be impacted. The best way to not only score well and focus without the use of artificial aids is to get a quality and good night’s rest.

**Dinner Time vs GPA**

 Also analyzing the results, we noticed that there was no correlation posed between dinner time and GPA. I was expecting a downwards trend because the later you ate dinner, would mean that you would have to stay up longer to let the food digest.



 Because a late dinner would then correlate to later sleep times, for optimal performance, there seems to be no indication of lower GPA with late dinner times. Interestingly enough, those that eat dinner earlier go to bed at the same time as those that eat dinner later, proving that dinner time is not a big factor when concerning sleep in high school students.

 One likely reason for a lack of correlation may be that despite the dinner time, studying for school needs to be done either way. However, if all the studying was regulated and if more controls were offered, I believe that it would be interesting to see if altered dinner times had any effect on GPA.

**Naps Taken vs Bedtime**

Analyzing the data, one final conclusion can be reached. The data shows that when naps are taken, students tend to fall asleep later, typically around usually an hour or two later. Those that do not take naps tend to fall asleep around 10 or 11, but those that take naps tend to go to sleep around 12 or 1.

 One reason for this is that the nap takes away work time, and although the following hours will be more focused and alert, the time spent sleeping could have also been used to work. With that being said, since less work is achieved in the earlier hours of the evening, the student would need to stay up later to work.

 Another reason is that the sleep wake cycle of the student is altered when they nap. For example, if a student naps, they will feel temporarily refreshed, and the sleep pressure that is pushing down is less strong in comparison to the brain telling the body telling it to stay awake. Since the sleep pressure is relieved, the student feels generally more awake in the later part of the evening, and does not get tired until the bedtime.

 Finally, a reason for a shift into the later bedtimes of those that nap may also be because of the natural teenage sleep cycle. While most adults begin to feel tired around 9 or 10, the hormonal release during the teenage years leads to a shifted sleep cycle, which reflects upon teenagers sleeping later, when they supposedly feel “awake”.

 To have healthy napping, a power nap should be taken consisting of 20-30 minutes, or a full sleep cycle, 90 -110 minutes. This way, the deep sleep is avoided, so upon awaking, there is no grogginess involved. If sleeping for 90-110 minutes, the deep sleep is achieved, but the alarm rings as the student is back in the early stages of sleep, and so, the student feels generally more awake and alert. There seems to be a balance between continued work and efficiency of the nap and resumed work, one that has yet to be found.

**Conclusion:**

While many of these theories have not been all completely proven, this study was a simple analysis of the data I was given. I hope that this will act as a starting point for future research, perhaps focusing on a single part of the comprehensive study I have done, with a bit more controls so that everything can be proved.

 I believe that constant awareness of the problems arising with sleep means that the problem needs to be addressed now, and I want to continue to be on the frontier of this interesting new science.

 By no means are these correlations set in stone, but these data are merely to be used as a starter for future and more accurate experiments.

 This was not an industry supported study, and I have no financial conflicts of interest.

1. "Teen Insomnia and Mental Health." *British Psychological Society*. British Psychological Society, 08 Jan. 2014. Web. 01 Aug. 2014. [↑](#footnote-ref-1)