EFFECT OF SLEEP PATTERN ON THE ACADEMIC PERFORMANCE OF UNDERGRADUATE STUDENTS

Benedict Agoha, Olujide A. Adekeye, Miriam U. Abengowe, David O. Igbokwe

Department of Psychology, College of Leadership Development Studies, Covenant university (NIGERIA)

Abstract

There have been studies that demonstrate the impact of sleep on both implicit and explicit memory. Of particular interest is that sleep has been shown to aid memory consolidation. This holds some implication for students, most of whom sleep for considerably very little amount of time, whereas they require sufficient amount of sleep to consolidate memory for material learned during the day. This study was therefore designed to investigate the possible impact of sleep on the academic achievement of undergraduate students. The study participants were 300 undergraduate students drawn from about twenty Department of a private university in Nigeria. 152 of the participants were female and the rest were male. The School Sleep Survey Habit Scale previously validated in Nigeria by one of the authors (IDO) was used to measure sleep habit, while academic performance was measured as self-reported grade. The result of Analysis of variance using SPSS XX showed a significant effect of Sleepiness on Academic Performance F (8, 211)=3.73, P<.01, and on Cumulative Grade Point Average, F (4, 190) = 3.82, P<.005. The study also showed that stimulant intake significantly impacted on Sleep habit. It was concluded that to enhance student's academic achievement counseling centres should endeavour to include sleep in their orientation programme for students. Besides, it would be necessary not to cram up the programme in such a manner that would rob the students of adequate rest and sleep.

Keywords: Sleep Habit, Academic performance, Undergraduate students, Memory.

1 INTRODUCTION

Sleep is a state of consciousness in which responsiveness to external stimulation is reduced. It is also accompanied by complex and predictable changes in physiology. Polysomnographic recordings in the laboratory indicate changes in brain waves and muscle. Three of these recordings, the electroencephalogram (EEG), electrooculogram (EOG), and electromyogram (EMG) have been recognized by psychophysiologists as standard measures for sleep (Pinel, 2011). A major difference between sleep and wakefulness is the reduced ability to respond to stimulus due to change in underlying physiology.

The purpose of sleep-related activities have been focus of scientific enquiry over the years. Meddis (1975) proposed the adaptive function of sleep. He argued that sleep helps animals reduce the risk of harm from predators during the part of the day when they are most vulnerable. During sleep, the animal conserves energy for wake time activity as indicated by the diminished metabolic activity, reduced muscular tension, blood pressure, and heart rate (Wickens, 2009). Another perspective was put forward by Oswald in which he pointed out the restorative role of sleep. He suggested that sleep restores depleted resources of energy, removes waste from muscles, and repairs cell. Most of these repair processes are said to occur during rapid eye movement (REM) sleep (Oswald, 1980; Hartman, 1984; Stern & Morgane, 1974). Sleep has also been linked to cognitive activities. It has been pointed out that poor retention of information occurs if individuals are deprived of sleep prior to learning (Moorcroft, 1993). Moreover, information is organized, consolidated, incorporated and stored during sleep (Paller & Voss, 2004). Sleep helps us reorganize and store information especially during REM. This theory also holds that sleep enables us learn new skills and how to make use of them. Some research also suggests that sleep helps to glue newly acquired information into the long term memory.

In support of this assumption, Karni, Tanne, Rubenstein, Askenasy, and Sagi (1994) showed that perceptual task memory consolidation in humans depends on REM sleep. Their study suggested that sleep is mandatory for memory trace formation in this task. There have been several other studies (Ambrosini et al., 2001). A notable study is that of Rani, Sarkis, Javad, Milena, Pavlova, and Bubrick et al (2016). They studied sleep-dependent memory consolidation in patients with focal epilepsy. They assessed declarative memory retention rate in in participants with focal epilepsy and found that

retention rate of 62.7% over 12 hour of wakefulness and 83.6% over another 12 hour which included sleep. The difference tested significant at $\rho < 0.04$. The Performance on overnight testing correlated highly with the duration of slow wave sleep (SWS) ($r = +0.63$, $p < 0.05$). They also found that day time seizure did not affect retention, whereas night time seizure resulted in more than 30% drop in retention. Some other studies (e.g. Cellini, Torre, Stegagno, and Sarlo, 2016) have shown that even day time nap facilitates memory consolidation regardless of the absence of REM or NREM sleep. It is considerably clear from the above literature that sleep is important for memory consolidation in humans.

1.1 Sleep Patterns/Schedules and Academic Performance

Circadian rhythms, consistent changes in mental and physical qualities that happen in the process of a day, have been thought to influence a wide variety of human activities. Based on individual differences in circadian pattern (morningness-eveningness), people may be classified along a conceptual dimension of morningness-eveningness trait. The morning type (M-T) person is mostly alert in the morning, while the evening type (E-T) is mostly alert in the evening (Önder, Beşoluk, İskender, Masal, & Demirhan, 2014; Natale & Cicogna, 2002). These traits may be determined or influenced by genetics (Adan et al., 2012) and other characteristics like age, gender, culture, social and environmental factors (Randler, Vollmer, Beşoluk, Önder, & Horzum, 2013). Disturbance of the sleep-wake pattern of an individual may affect attention to details and concentration as is commonly experienced in jetlag. It seems therefore that chronotype would confer academic advantages on some students, and disadvantage on others. Expectedly, a number of studies have found significant relationships between chronotype and academic achievement. Relationships between chronotype and academic achievement. In keeping with earlier studies (Kirby & Kirby, 2006; Randler & Frech, 2006) Onder et al (2014) found among university students that earlier chronotypes obtained higher CGPAs than later chronotypes. They also observed better sleep quality and academic motivation in their female sample.

Similar results have been found for school children. Merdad, Merdad, Nassif, El-Derwi, and Wali (2014) noted that lower grade points was more prevalent among students who experienced reversed sleep cycle on week days. Other researchers (Lauren, Asarnow, McGlinchey, & Harvey, 2013; Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002; Giannotti & Cortesi, 2002; Wagner & Roberts, 2003) demonstrated similar negative association of eveningness on academic achievement. Preckel, Lipnevich, Schneider, and Roberts (2011) conducted a meta-analytic study in which they found that eveningness correlated positively with cognitive ability but inversely with academic achievement. Conversely, morningness correlated negatively with cognitive ability and positively with academic achievement. These studies show that sleep pays important role in cognitive functioning and academic performance.

Studies on Sleep duration is neither here nor there. Titova, Hogenkamp, Jacobsson, Feldman, Schioth, and Benedict (2014) studied a cohort of 40000 school children and noted that self-reported sleep disturbance and short duration of sleep, defined as sleep less than 7 hours, predicted academic failure. Their findings agree with Asarnow et al., (2013), and with Dewald, Meijer, Oort. Kerkhof and Bogels (2010). But others like Gruber, Somerville, Enros, Paquin, and Kestler et al (2014) and Tonetti, Fabbri, Filardi, Martoni and Natale (2015) have found that sleep efficiency rather than duration is necessary for quality academic performance.

1.2 Aims of the Study

Although scientific literature is replete with studies which clearly demonstrate the effects of sleep on academic achievement, only little contribution or no has come from Nigeria. This is important as ethnicity and a wide range of differences between human impacts on chronotype. Our aims therefore are to determine the effect of sleepiness and sleep-wake behavior on academic performance, defined as cumulative grade point average (CGPA).

2 METHOD

2.1 Participants

The participants were 300 fully resident undergraduate student volunteers from a privately-owned university in Nigeria. 148 (49.33%) were male and 152 (50.67%) were female. They ranged between 15-21 years in age Mean = 17.5, SD = 1.2).

2.2 Instrument

The School Sleep Habits Survey (SSHS) developed at Bradly Hospital was used to measure sleepiness and sleep-wake cycle. The SSHS is a sixty-three (63) item, self-report scale that measures the sleep habit of adolescence. The scale also has four subscales which are: the sleepiness scale, the sleep/wake behavior problem scale, the depressive mood scale and the stimulant intake subscale. The SSHS has been validated in different countries and also Nigeria by one of the present authors (IDO). The sleepiness, sleep/wake behavior problem, and depressive mood subscales showed internal consistency of .70, .75, and .79 respectively. Cronbach α of the subscales were 0.87 for sleepiness, 0.71 for stimulant intake. Cronbach alpha for sleep-wake behavior subscale was 0.78, and 0.87 for the depressed mood subscale.

3 RESULTS

One-Way analysis of variance was performed on the data obtained using the using the Statistical Package of Social Science, Nineteenth Edition (SPSS-20). The result is presented below.

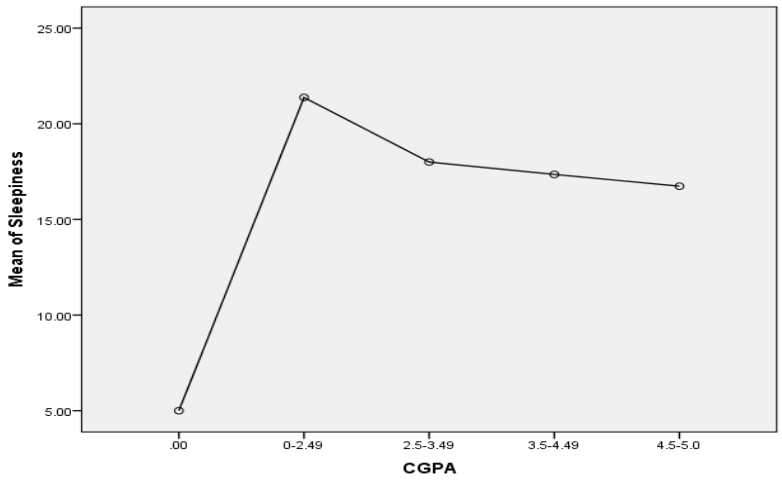

Figure 1: Representation of the effect of sleepiness on academic performance (CGPA)

Figure 1 above is the graphical representation of the effect of sleepiness on academic performance. It can be seen that persons with CGPA 0.2-2.49 (Third class result) reportedly experienced more sleepiness. Sleepiness then dropped continuously as CGPA increased. Table 1 shows the result of one-way analysis of the data.

Table 1: Effect of sleepiness on CGPA

SOV	Sums of Squares	df	Means Square	F	Sig
Between Groups	466.53	4	116.63	3.82	.005
Within Groups	5796.29	190	30.51		
Total		6262.82	194		

Table 1 above shows the effect of sleepiness on CGPA of the participants. The result indicates that sleepiness had significant effect on the CGPA of students (f (4190) =3.82, ρ<.01). Figure 1 is a graphical representation of the effects of sleepiness on CGPA.

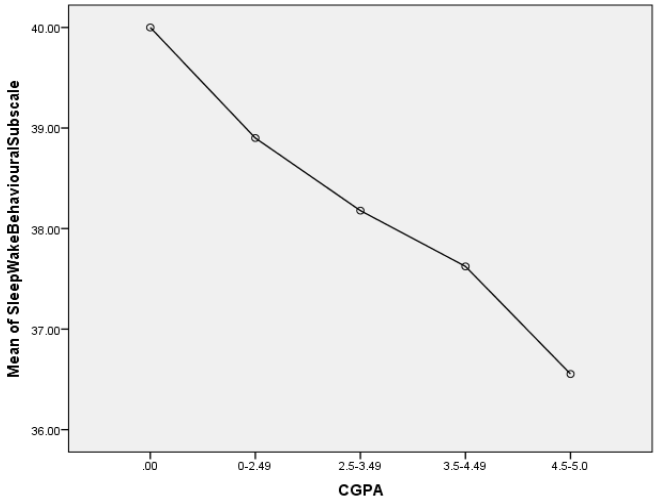

Figure 2: Effect of sleep-wake behaviour on academic performance

Figure 2 above shows the plot of mean sleep-wake behavior scores on academic performance (CGPA). The plot reveals an inverse pattern of relationship between both variables, suggesting that academic performance tend to drop as sleep-wake cycle increases during sleep. The ANOVA table is presented below.

Table 2: The effect of sleep-wake behavior on CGPA

SOV	Sums of Squares	df	Means Square	F	Sig
Between Groups	97.87	4	24.47	.42	.79
Within Groups	12158.65	208	58.45		
Total	12256.52	212			

The table above shows that the effect of sleep-wake behavior on academic performance was not significant. This is in spite of the inverse relationship pattern shown by figure 2.

4 DISCUSSIONS AND CONCLUSION

The results of this study indicated that sleepiness has significant effect on academic performance. This is in line with earlier findings like that of Shin, Kim, Lee, Ahn, and Joo (2003) who found significant effect of sleep habits and excessive daytime sleepiness (EDS) on school performance in senior high school students. The Epworth Sleepiness Scale defined the excessive daytime sleepiness of each participant. Sleep-wake behavior on the other hand the not significantly impact on academic performance, even though a clear pattern of inverse relationship was shown. This result contradicts BaHammam, Alaseem, Alzakri, Almeneessier and Sharif (2012) who found that that decreased nocturnal sleep time, late bedtimes during weekdays and weekends, catch-up sleep on weekends and increased daytime sleepiness were negatively associated with academic performance in medical students. We conclude from the result of this study that sleep is an important determinant of academic performance.

4.1 Implication

This holds some implication for policy makers, school administrators, counselors, and educators planning to improve students' academic performance. Most times underachieving students are not evaluated for sleep disorders or their sleep behaviours. It is possible that some academic failures may relate to sleep dysfunction, or be pointer to some underlying dysfunctions that interfere with the

restorative role of sleep. Therefore, efforts should be made at considering the potential benefits of taking a multidisciplinary approach towards and promoting the academic and behavioural wellness of students.

REFERENCES

[1] Ambrosini, M.V. & Guiditta, A. (2001). Learning and sleep: The sequential hypothesis. Sleep Medicine Review, 5, 477-90.

[2] Adan, A., Archer, S. N., Hidalgo, M. P., Di Milia, L., Natale, V., & Randler, C. (2012). Circadian typology: A comprehensive review. Chronobiology International, 29(9), 1153–1175.

[3] Asarnow, L. D., McGlinchey, E. & Harvey, A. G. (2013). The effects of bedtime and sleep duration on academic and emotional outcomes in a nationally representative sample of adolescents. Journal of Adolescent Health, 54, 350-356.

[4] Cellini, N., Torre, J., Stegagno, L., & Sarlo, M. (2016). Sleep before and after learning promotes the consolidation of both neutral and emotional information regardless of REM presence. Neurobiology of Learning and Memory, 133, 136-44. doi:10.1016/j. nlm. 2016.06.015.

[5] Dewald, J. F., Meijer, A. M., Oort, F .J. Kerkhof, G. A. & Bogels, S. M. (2010). The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. Sleep Medicine Reviews, 14, 179–189

[6] Fischer, S., Hallschmid, M., Elsner, L. A., & Born, J. (2002). Sleep forms memory for finger skills. PNAS, 99, 11987-91.

[7] Giannotti, F. & Cortesi, F. (2002). Sleep patterning and daytime functioning in Adolesce nce: An epidemiological survey of an Italian high school student sample. Sleep, 27, 299-304.

[8] Giannotti, F., Cortesi, F., Sebastiani, T., & Ottaviano, S. (2002). Circadian preference, sleep and daytime behaviour in adolescence. Journal of Sleep Research, 11, 3, 191-9.

[9] Gruber, R., Somerville, G., Enros, P. Paquin, S., Kestler, M., & Gillies-Poitras, E. (2014). Sleep efficiency (but not sleep duration) of healthy school-age children is associated with grades in math and languages. Sleep Medicine, 15, 1517–1525.

[10] Hartmann E (1984): The Nightmare: The Psychology and Biology of Terrifying Dreams. New York: Basic Books.

[11] Karni, A., Tanne, D., Rubenstein, B.S., Askenasy, J. J. M., and Sagi, D. (1994). Dependence on REM sleep of overnight improvement of a perceptual skill. Science, 265, 679- 682.

[12] Meddis, R. (1975). On the function of sleep. Animal Behaviour, 23, 3, 676–691.

[13] Merdad, R. A., Merdad, L .A, Nassif, R. A., El-Derwi, D., & Wali, S.O. (2014). Sleep habits in adolescents of Saudi Arabia; distinct patterns and extreme sleep schedules. Sleep Medicine, 15, 1370–1378.

[14] Moorcroft, W. H. (1993). Sleep, dreaming, and sleep disorders. New York: University Press of America.

[15] Natale, V., & Cicogna, P. C. (2002). Morningness–eveningness dimensions: Is it really a continuum? Personality and Individual Differences, 32, 809–816.

[16] Önder, I., Beşoluk, S., İskender,M., Masal, E., & Demirhan, E. (2014). Circadian Preferences, sleep quality and sleep patterns, personality, academic motivation and academic achievement of university students. Learning and Individual Differences, 32, 184–192.

[17] Oswald, I. (1980). Sleep studies in clinical pharmacology. British Journal of Clinical Pharmacology, 10,317-326.

[18] Paller, K. A., & Voss, J .A. (2004). Memory reactivation and consolidation during sleep.Learn Mem, 11, 6, 664–670. doi: 10.1101/lm.75704

[19] Preckel, F., Lipnevich, A.A., Schneider, S., & Roberts, R.D. (2011). Chronotype, cognitive abilities, and academic achievement: A meta-analytic investigation. Learning and Individual Differences, 21, 483–492.

[20] Randler, C., & Frech, D. (2006). Correlation between morningness–eveningness and final school leaving exams. Biological Rhythm Research, 37, 233–239.

[21] Randler, C., Vollmer, C., Beşoluk, Ş., Önder, İ., & Horzum, M. B. (2013). Age and gender differences in morningness–eveningness in Turkish adolescents and young adults. Biological Rhythm Research, 45, 2, 277-284. http://dx.doi.org/ 10.1080/ 09291016.2013.805915.

[22] Sarkis, R. A., Alam, J., Pavlova, M. K., Dworetzky, B. A., Pennell, P. B., Stickgold, R. & Bubrick, E. J. (2016). Sleep-dependent memory consolidation in the epilepsy monitoring unit: A pilot study, Clinical Neurophysiology, 127, 2785–2790.

[23] Shin, C., Kim, J., Lee, S., Ahn, Y., & Joo, S. (2003). Sleep habits, excessive daytime sleepiness and school performance in high school students. Psychiatry & Clinical Neurosciences, 57, 4, 451-453.

[24] Stern, W. C. & Morgane, P. J. (1974). Theoretical view of KEM sleep function: maintenanceof catecholamine systems in the central nervous system. Behavioural Biology, 11, 1- 32.

[25] Titova, O. E., Hogenkamp, P. S., Jacobsson, J. A., Feldman, I. , Schiöth, H. B., & Benedict, C. (2015). Associations of self-reported sleep disturbance and duration with academic failure in community-dwelling Swedish adolescents: Sleep and academic performance at school. Sleep Medicine, 16, 87–93.

[26] Wagner, D., & Roberts, R. D. (2003). Zusammenhänge zwischen Chronizität (LOCI), Intelligenz und Persönlichkeit [Relationship between chronotype (LOCI), intelligence, and personality]. Retrieved from http://www.psychologie.uni-man nheim.de /psycho2 /publi/ papers/halle_2003_wagener.pdf