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The Global Sleep Crisis and University Education: Counseling Implications for Mathematics Education Students in Nigeria

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Abstract: Sleep has been considered a vital component of mental, physical and academic well-being of higher education students. This study adopts the survey research design to investigate the pattern of some sleep variables among mathematics education students in North Central Nigeria. The sample comprises 215 mathematics education students randomly drawn from two federal universities in North Central Nigeria. The instrument for data collection is the researcher-developed Technology Usage and Sleep Pattern Questionnaire (TUSPQ). Data collected on use of electronic device at bedtime, screen time during daytime, sleep onset latency (SOL), wake after sleep onset (WASO), subjective sleep need (SSN), nighttime phone location and nighttime awakenings were analyzed using frequency counts, simple percentages and means. The results indicate dismal sleep duration of 5 hours and 19 minutes and a sleep deficit of 2 hours and 35 minutes attributable to high use of smartphones, laptops and TVs in the last hour before going to bed. The implications of these findings for counseling interventions in Nigeria's higher education system were considered.

Key-words: Sleep, Sleep Deficiency, Sleep Counseling, Mathematics Education, Higher Education.

1. Introduction

University education in Nigeria is the apex of the educational pyramid for young adults seeking intellectual advancement, skills development and career growth. It is a significant stage in the education of the Nigerian child,

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especially as it is the only level of education in the country in which the student exhibits true autonomy. The basic education and secondary education levels from which the student emerged are characterized by checks and balances enforced by parents, guardians, caregivers and sponsors. Most basic and secondary schools in Nigeria even adhere to regular use of school uniforms, a kind of forbearance most children cannot wait to exit. As such an admission into higher education also implies an admission into personal liberty on the part of most students, a liberty of choices that will definitely define the degree of success of students' university education.

One of the choices students in university had to make early enough is the choice of sleep. This simple choice had hitherto been under the supervision of adults who are deemed to know the impact of sleep on academic progression. Once off the careful eyes of such supervision, most students are confronted with the challenge of establishing a personal schedule that is flexible enough to accommodate the academic and socio-cultural demands of their university education. The challenge becomes more attenuated by the encroaching presence of smartphones, gaming consoles, betting centres and other encumbrances of a typical night life. In the end, the typical mathematics education student finds himself confronted with the realities of sleep deprivation and cognitive overload often resulting to stress, impacting all-round well-being of the student.

Sleep is a dynamic activity that is essential for human well-being like food and water. Sleep is, in essence, food for the brain and insufficient sleep can be harmful, even life threatening (National Sleep Foundation, 2000). Sleep is an opportunity for the body to repair itself. Some forms of sleep are associated with physical repairs such as torn muscles and organ cleansing while other forms of sleep are associated with psychological repair such as laying down memories and working through anxiety (Williams & Carey, 2003). A widely accepted sleep-wake cycle which consists of roughly 8 hours of nocturnal sleep and 16 hours of daytime wakefulness is controlled by a combination of sleep homeostasis and circadian rhythms (National Sleep Foundation, 2000). The disruption of the sleep-wake cycle results in sleep loss, an accumulation of sleep debt that must eventually be repaid.

Deficits in daytime performance due to sleep loss are experienced universally and associated with significant social, financial and human cost (Durmer & Dinges, 2005). The spread of this core societal problem is indeed global and has come to be termed the "global sleep crisis" (Walch, Cochran & Forger, 2016; Gallagher, 2016). All over the world people are increasingly cheating on sleep, with the trend significantly steeper for teens and university students (Willingham 2013). An obvious correlation of this trend with increased use of smartphones, light-emitting e-readers, and social networks has been widely reported (Chang, Aeschbach, Duffy & Czeisler, 2015; Mark Wang, Niiya & Reich, 2016). Also, the effects on cognitive functioning,

daytime alertness, task performance and critical thinking have been reported across wide demographic characteristics (Horne, 1988; Stepanski, 2002; Griffith & Mahadevan, 2006; Ramadani *et al.*, 2013).

The seriousness of sleep-related problems in Nigeria is, however very unique. Nigeria is a rapidly growing technology hub in Africa and some Nigerians consider early adoption of new digital technology as an integral part of social status display. Twinpine Network (2016) reported that Nigeria is the most mobilized country in the world ahead of India and South Africa with 40% mobile penetration and 30% Smartphone penetration rate. Nigerians spend 193 minutes on Smartphone daily across all media (Twinpine Network, 2016), and a huge chunk of these users are university students. There is, therefore, the need to consider sleep dynamics with these country-specific realities in mind.

Earlier works on sleep related issues from within Nigeria have vividly established the risk sleep deprivation poses for students. Maduabuchi *et al.* (2014) observed that adolescents have varying degrees of sleeping practice and hygiene. Williams and Aderanti (2014) reported a significant relationship between adequate/inadequate sleep and academic performance among under graduate students of private universities in Ogun State, South west, Nigeria. In another study, almost a third (32.5%) of medical students from a Nigerian university reported poor quality sleep (James, Omoaregba & Igberase, 2011). Okunbor, Agwubike and Emelike (2010) also observed that inadequate sleep militated against the performance of students of Nigerian tertiary institutions in rigorous fitness and recreational activities.

A study from the Middle Belt (North Central) region of Nigeria observed that, a substantial number of students had borderline nighttime sleep duration and so had potentials to transit into the problematic insufficient range (Sanya *et al.*, 2015). Sanya *et al.* (2015) also reported that 10% of teenagers do make regular phone calls at night and 5.5% surf internet on computers and smartphone at night.

Most of the studies emanating from Nigeria however focused on students at the secondary level of education. The few ones from tertiary institutions were carried out by health practitioners who often end up recommending that affected students seek help. The studies failed to stress the specific intervention required by undergraduates to adequately adjust their lifestyles and handle sleep-related outcomes in their university education. There is also a shortage of research reports from North Central Nigeria on the dynamics of sleep deprivation, particularly as they relate to Mathematics education students. It is against this backdrop that this present study sought to investigate the gravity of the global sleep crisis among mathematics education students in universities in North Central Nigeria.

2. Theoretical Foundations of Sleep Research

Sleep has been many things to different people over the course of human history. Early theories and observations from the ancient Greek and Romans including Alcmaeon, Empedocles of Agrigentum, Diogenes, Aristotle and Galen view sleep as an affection of the sensitive part of the soul, an absence of motion and a state of powerlessness due to excess waking (Papachriston 2014). These early perspectives consider sleep as passive, near-death state, inactive, lack of brain and body activity. As time progresses, particularly during the Renaissance period, the brain came to be recognized as the source of sleep, driving more enquiries into the function of sleep. With the advent of technology to record electrical activity in the brain, sleep came to be seen as indeed functionally important and that it ultimately enhances survival (Rechtschaffen, 1998).

A theory of sleep is an attempt to explain why animals sleep. According to Sammons (n. d.), a good theory of sleep should provide a plausible explanation as to why sleep is found in such a variety of different animals. It should explain the findings of research studies into sleep deprivation and shed light on the differences that exist in sleep patterns between different species. There are two general approaches taken by theories of sleep. On the one hand, Restoration Theories (credited to key players including Ian Oswald), suggests that sleep exists in order to repair and restore the body. On the other hand, the Evolutionary Theories relate sleep to the ability to survive in a hostile environment.

The Restoration Theories of sleep has been providing theoretical foundations for sleep deprivation studies for decades. According to this line of reasoning, the function of sleep is to restore the body during periods of inactivity so that adequate biological functioning is ensured. The tissues of the brain and body are repaired and the chemicals needed for proper functioning are replenished (Sammons, n.d.) Assefa, Diaz-Abad, Wickwire and Scharf (2015) reported that a new rendition of the physical restoration point of view by Markus H. Schmidt considers sleep based on the need to optimally allocate limited energy resources to essential biological processes. Schmidt's Energy Allocation Model of sleep posits that the sleep-wake cycle evolved to perform unique and essential biological processes during sleep as a way to decrease energy requirements of wakefulness and reduce total daily energy expenditure. Assefa *et al.* (2015) argued that hormones released during sleep assists in memory formation and performance of higher level cognitive functions essential for learning and survival.

Neuroscientific studies of sleep have defined sleep on the basis of behavioural and physiological criteria dividing it into two stages: non rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. Both the NREM and REM sleep alternate in a cyclic manner with a total of 4 to 6

cycles noted during sleep in adults and each cycle lasting on average from 90 to 110 minutes (Chokroverty, 2010). In adult human, the first third of sleep is dominated by the slow wave sleep and the last third is dominated by REM sleep. The REM is often characterized by rapid eye movement and muscle atonia. This categorization of sleep results in different stages of sleep. Saey (2009) recognized five stages of sleep, with the first four stages characterized by drop in heart rate, body temperature and brain activity, supporting the view that sleep serves to save energy.

The brain orchestrates the daily sleep-wake cycle by responding to external ones, such as sunlight and the body's own rhythms. Levels of chemical messengers, hormones and proteins rise and fall in key parts of the brain to generate wakefulness and sleepiness. Tracking brain activity during sleep, scientists have also revealed regions important for other putative functions of sleep, such as memory storage and information processing (Saey 2009). The information processing task of the brain is what makes the connection of sleep to academic well-being a very strong one. The role of sleep in the overall health of the central nervous system underscores its importance for students, for which lack of sleep can lead to deficiencies in concentration, reaction time and overall alertness (Oelschlager, n. d.; Short & Banks, 2014).

For the mathematics education student, the impact of sleep deprivation is crucial. This is because of the frequency of problem solving, procedural fluency and critical thinking teacher preparation in mathematics requires. The reported trend is that students tend to stay up late negating the recommended 7-8 hours of deep sleep because they had to work to pay for school, they are trying to finish an assignment that is due the next day, or they are engaged in a leisure activity (Schumacher & Sipes, 2015). Using restoration theories of sleep, evidences have been turned up showing a variable (negative) impact of sleep deprivation on students' mood, cognitive performance and motor function due to an increasing sleep propensity and destabilization of the sleep-wake state (Durmer & Dinges, 2005).

3. The Pivotal Role of Psychological Counseling

A scenario reported across several Nigerian news outlets at the close of 2016 underscores the importance of sleep, even for those in "high places". According to Premium Times (2016), the Governor of Yobe State directed a sleeping commissioner at the presentation of the 2017 budget to the State House of Assembly to go home for more sleep. The news report indicated that the governor had barely commenced reading the budget speech when the cabinet member started snoring. Such displays of obvious sleep debt, which are becoming regular at many televised official seating (including the

National Assembly), are sharp indicators of the sleep time bomb on which the society is sitting.

On a grand scale, Hafner *et al.* (2016) in a study for RAND Europe unveil amazing statistics on the causes, consequences and related economic costs of insufficient sleep. The empirical findings of this RAND Europe research into the economic burden of insufficient sleep across five different OECD countries suggest that workers who sleep less than six hours per day report on average 2.4% point higher productivity loss due to absenteeism or presenteeism than workers sleeping between seven to nine hours per day. Economically, this loss translates to $680 billion across the five OECD countries. For students, sleep deprivation results not only in being too tired to concentrate on school work, but also in brains that would not work to full capacity (Ansell, 2012). The emotional and mental disarray associated with sleep deprivation definitely affects students' academic performance and as such students with sleep problems need serious help (Dawson 2005). Such helps are often available to students via psychological counseling provided by higher educational institutions and other partnering organizations (GoodTherapy.Org, 2016).

Although the fact on individual differences makes it impossible to set precise recommendation about how much sleep is sufficient, there is a clear consensus about what constitutes insufficient sleep. Available guidelines frequently provide a range of hours individuals should sleep every night, and by extension, anything falling short of the recommended lower boundary can be understood as constituting insufficient or short sleep, giving rise to sleep deprivation, particularly if this is a regular occurrence (Hafner *et al.*, 2016). Table 1 shows a range of International Sleep Guidelines. Sleep counselors and other mental health practitioners often fall back to these guidelines when rendering help to individuals with sleep problems

Source	**Guideline**
National Sleep foundation	7 – 9 hours
Mayo Clinic	7 – 9 hours
National heart, Lung and Blood Institute	7 – 8 hours
Royal college of psychiatrists	Around 8 hours

Table 1. *Selected International Sleep Guidelines (Source: Hafner et al.., 2016)*

Sleep therapist look for general sleep-related characteristics such as poor quality of sleep, insufficient sleep and sleep that comes at inappropriate times. Fatigue and diminished capacity for cognitive focus are two of the most noticeable concerns of sleep disorder among students (GoodTherapy.Org, 2016). Counseling for sleep-wake disorders generally focuses on changing behaviour, setting and achieving goals, becoming more self-aware and learning relaxation skills. Once the root cause of a sleeping problem has been

uncovered, counselors can help victims develop skills to modify unwanted sleep patterns. According to GoodTherapy.Org (2016), methods used in therapy to address sleep-wake disorders include keeping a sleep diary, stimulus control instruction, sleep hygiene education, relapse prevention, phototherapy and dark therapy.

Several special sleep counseling interventions have revealed the pivotal role psychological counseling plays in sleep therapy. Matthew, Hughes and Rogers (2014) affirmed that when considering quality of life, in the domains of Role Emotional Score, Mental Health Score and Mental Component Score, it can be concluded that counseling has a positive effect on emotional health and mental well-being. Similarly, a pilot project by Sleep Scotland enables students to understand the process of sleep, why it is so important for their well-being and strategies they could implement to promote a good night's sleep (Ansell, 2012). Some of the strategies recommend restricting homework exercise and computer games to the early evening, keeping to a regular bedtime and setting the hour before bedtime for relaxing and bathing. Other outcome studies based on non-pharmacological treatments for sleep deprivation have shown very good outcomes for individuals engaging in psychological and behavioural approaches (All in the Family Counseling Centre, 2016).

The need for psychological counseling is very much highlighted when considered in line with the unique demographic characteristics of university students. Typically, students who sleep less than the average are seen to be more active, sociable, ambitious and extroverted, while those who sleep more than eight hours a night have been found to be more introverted, critical and significant worriers (Oelschlager, n. d.). Most students are thus left battling for a balance between social acceptability and a desirable sleep-dependent mental health. It is also difficult for most students to shake off misconceptions about hardwork, resulting in very few students identifying the importance of sleep and even the need to seek help on sleep related issues.

4. Empirical Studies

The first sleep deprivation study by Patrick and Gilbert was published over a hundred years ago and since then many studies have examined the impact of sleep deprivation on healthy functioning (Short & Banks, 2014). With respect to schooling, the impact of sleep deprivation, sleep restriction and sleep fragmentation on cognition, sustained attention and mood is a reflection of the effect sleep has on the neural systems that control these functions. The field of sleep psychology is already well-researched and any highlighting of studies can only be representative and perhaps demographic-specific.

In a study on sleep loss and divergent thinking ability, Horne (1988) examined task performance levels of 12 subjects who went 32 hours without sleep against a control of 12 other subjects who had normal sleep. After administering the Torrance Tests of Creative Thinking, the study observed that performance of tasks was significantly impaired by sleeplessness, indicating serious impact on divergent and creative thinking. Much recent study by Stepanski (2002) also affirmed that even fragmented sleep, which is less restorative than consolidated sleep, leads to sleepiness-related daytime impairment.

Modern studies have tried to isolate factors that contribute to sleep deprivation in an attempt to measure specific cause and effect relationship. For instance, Chang *et al.*. (2015) found results that demonstrate that evening exposure to light-emitting eBook readers phase-delays the circadian clock and reduced next-morning alertness. Similarly, Mark *et al.*. (2016) after logging computer and phone use data and collecting sleep diaries and daily survey of 76 college students for seven days, observed that with less sleep, people report higher perceived work pressure. This result suggests that with less sleep, people may seek out activities requiring less attentional resources such as social media use. Another study by Van der Helm, Gujar and Walker (2010) observed that sleep deprivation selectively impairs the accurate judgment of human emotions, especially threat-relevant (anger) and reward-relevant (happy) emotions, thereby disrupting salient affective social cues.

In an African study, Gikunda *et al.*. (2014) observed a positive correlation between sleep quantity and academic performance in a sample of 100 undergraduate students of public universities in Kenya. Similarly, the cumulative grade point average (CGPA) of Nigerian undergraduates was observed to be related to their quality of sleep (Williams & Aderanti, 2014). Poor quality of sleep was also observed among Medical students in Nigeria with particular association with predisposing and several modifiable factors (James, Omoaregba & Igberase 2011). Considering students perspectives on sleep, Aloba *et al.* (2007) reported that despite the critical nature of sleep problems in Nigeria, many university students do not perceive their sleep problems to affect their functioning because they need to read, especially at night, to survive academic pressure.

Some recent empirical works are particular in their measure of specific sleep variables such as time in bed, sleep duration, sleep onset latency, wake after sleep onset and sleep deficit. Hysing *et al.* (2013) and Hysing *et al.* (2015) refined a systematic approach to measurement of sleep parameters using simple self-reported questionnaires. Hysing and associates computed sleep deficit by subtracting sleep duration from subjective sleep need, with sleep duration being a function of time in bed, sleep onset latency and wake after sleep onset. Similar simplicity was applied by Rosen *et al.* (2016) in

relating nighttime phone location and night time awakenings to sleep deprivation.

Although evidences abound on the patterns of sleep of diverse demographic categories from Nigeria, very few studies considered specific measurement of sleep variables. Maduabuchi *et al.* (2014), for instance, observed a weekday sleep duration of 7.84 hours and varied SOL (< 5minutes and > 30 minutes) among adolescent secondary school children in Nigeria. Also, there seem to be shortage of empirical research with specific consideration of the role of increasing technological penetration among Nigerian undergraduates in their eventual sleep patterns. Leveraging on the most recent approaches to survey on sleep, this present study sought to analyze the prevalent sleep patterns of mathematics education students in Nigeria and the relationships among variables such as screen time during daytime, nighttime phone location, nighttime awakenings and sleep deficiency. The perspective of students on the need for counseling was also considered.

5. Research Questions

The following questions guided the study:

1. What are the electronic devices mathematics education students in Nigeria use in the last hour before going to sleep?
2. How much screen time do mathematics education students in Nigeria spend on electronic devices on week days?
3. What is the pattern of nighttime phone location among mathematics education students in Nigeria?
4. How often do mathematics education students in Nigeria awake to attend to phones in a typical nighttime?
5. What is the mean sleep duration among mathematics education students in Nigeria?
6. What is the level of sleep duration among mathematics education students in Nigeria?
7. What proportion of mathematics education students in Nigeria considered the option of seeing a counselor about sleep related problems?

6. Methodology

This study employs the survey research design to investigate the pattern of some sleep variables of mathematics education students in North central Nigeria. The target population is the 5106 mathematics education students from two (2) Federal Universities in North Central Nigeria. The sample

comprises 215 mathematics education students drawn randomly from the two Federal Universities.

The instrument for data collection is the Technology Usage and Sleep Pattern Questionnaire (TUSPQ) which is an adaptation of survey instruments provided by Hysing *et al.* (2015) and Rosen *et al.* (2016). The TUSPQ is made up of nine self-reported items providing responses on use of electronic devices at bedtime, screen time during daytime, bedtime, rise time, sleep onset latency (SOL), wake after sleep onset (WASO), subjective sleep need (SSN), nighttime phone location and nighttime awakenings.

Electronic devices considered in this survey are PC (desktop), laptop, smartphone, MP3 Player, tablet, game console and TV. Bedtime, the time one settles into bed for the night, is reported in hours and minutes (for example 10:36pm). Rise time is the time one gets up from sleep (in the morning) reported in hours and minutes. SOL is the length of time it takes to actually fall asleep after bedtime while WASO is the time duration it takes one to fall back to sleep after waking up in the "middle" of sleep. Both SOL and WASO are reported in minutes as either less than or greater than 60 minutes. Time in bed (TIB) is obtained by subtracting bedtime from rise time. Sleep duration was computed by subtracting the combination of SOL and WASO from TIB, SSN is each individual's own perceived sleep need reported in hours and minutes. Sleep deficit, a measure of sleep deficiency, was computed by subtracting sleep duration from subjective sleep need. The deficit was categorized into less than 2 hours and greater than (or equal to) 2 hours. All sleep variables are reported based on weekday experience. Nighttime phone location was considered as either close to the participant (under the pillow, on the bed, or next to the bed) or far away from the participant (in the bedroom but not close to the bed, in another room or other location). Nighttime awakenings are categorized into never, once a night and 2 or more times a night.

Statistical tools used for data analysis and presentation in this study are descriptive statistics. Frequency counts, simple percentages and means were used to answer the research questions. Bar charts and pie charts were also employed in the data presentation.

The participants in this survey voluntarily chose to fill out the TUSPQ. Copies of the questionnaire were circulated and retrieved by the researchers through direct contact with the participants.

7. Results

The results of this survey are presented according to the research questions.

7.1. Research Question One

What are the electronic devices mathematics education students in Nigeria use in the last hour before going to sleep?

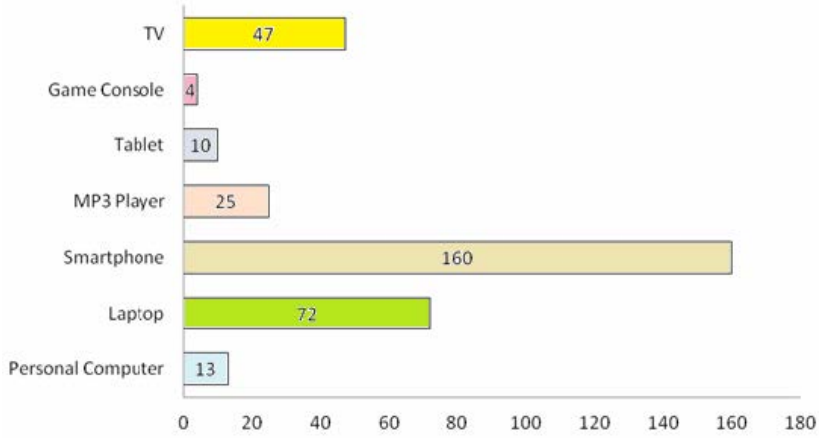

Figure 1. *Electronic Devices Used in the Last Hour before Going to Sleep*

The bar chart in Figure 1 indicated that a high number of mathematics education students in Nigeria use smartphones (160), laptops (72) and TVs (47) in the last hour before going to bed.

7.2. Research Question two

How much screen time do mathematics education students in Nigeria spend on electronic devices on weekdays?

Analysis of results on time spent on electronic devices and activities is presented in five pie charts showing time spent by mathematics education students on Email, TV games, Computer games, Social media, and using electronic devices for other purposes on week days.

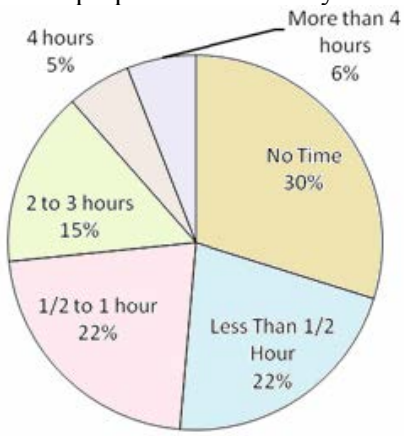

Figure 2. *Time Spent on Email*

Figure 3. *Time Spent on TV Games*

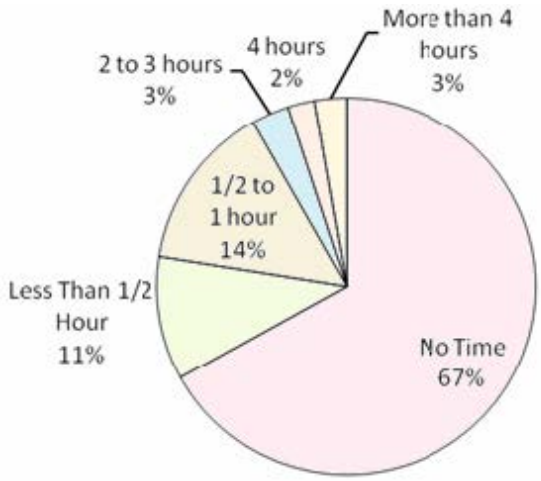

Figure 4. *Time Spent on Computer Games*

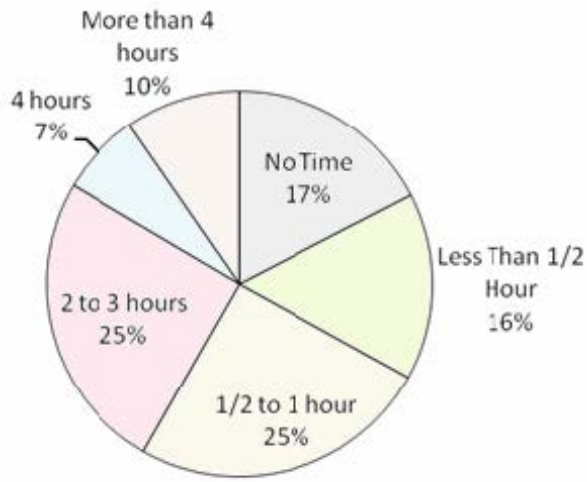

Figure 5. *Time Spent on Social Media*

Figure 6. *Time Spent on Digital Devices for other Purposes*

A critical look at the pie charts reveals that the percentage of students spending "No Time" on electronic devices/activities reduced drastically in Figure 5 (Time spent on social media) to a meager 17%, indicating a widespread indulgence in social networking among mathematics education students in Nigeria.

7.3. Research Question Three

What is the pattern of nighttime phone location among mathematics education students in Nigeria?

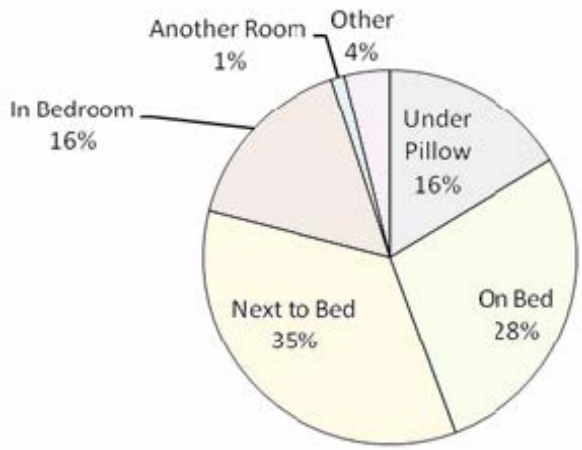

Figure 7. *Nighttime Phone Location among Mathematics Education Students in Nigeria*.

The pie chart on Nighttime Phone Location indicates that 79% of mathematics education students in Nigeria have their phones very close to themselves every night (under pillow, on bed and next to bed). Conversely only 21% of the students keep their phones away from themselves every night (somewhere else in the bedroom, in another room, and other locations).

7.4. Research Question Four

How often do mathematics education students in Nigeria awake to attend to phones in a typical nighttime?

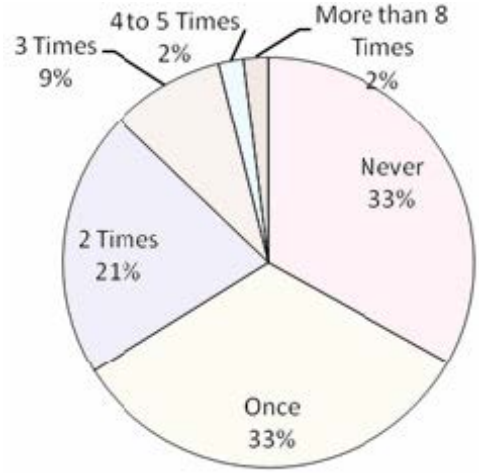

Figure 8. *Night Awakening to Attend to Phone by Mathematics Education students in Nigeria.*

The pie chart in Figure 8 indicates that 34% of the students wake up more than once at night to attend to their mobile devices. The remaining 66% wake up either once to attend to phones or not at all.

7.5. Research Question Five

What is the mean sleep duration among mathematics education students in Nigeria?

S/NO.	TIB	SOL	WASO	SDur [=TIB - (SOL+WASO)]	CatSDur	SSN	SDef [=SSN - SDur]	CatSDef
1	6.40	0.30	0.10	6.00	5 to 6 hours	7.30	1.30	Less than 2 hours
2	8.00	0.30	0.01	7.29	7 to 8 hours	6.00		
3	4.30	1.30	2.00	1.00	Less than 4 hours	6.00	5.00	Greater than 2 hours
4	7.30	0.30	0.30	6.30	6 to 7 hours	6.00		
5	9.30	0.30	1.00	8.30	8 to 9 hours	0.30		
6	7.00	0.30	0.10	6.20	6 to 7 hours	12.00	5.40	Greater than 2 hours
7	6.00	0.30	0.05	5.25	5 to 6 hours	3.30		
8	6.30	1.30	0.30	4.30	4 to 5 hours	1.00		
9	11.00	0.30	0.30	10.00	9 to 10 hours	7.00		
10	5.00	0.30	2.00	2.30	Less than 4 hours	3.00	0.30	Less than 2 hours

11	4.30	0.30	0.20	3.40	Less than 4 hours			
12	5.30	0.30	0.20	4.40	4 to 5 hours	10.00	5.20	Greater than 2 hours
…								
…								
…								
…								
209	5.00	1.30	2.00	1.30	Less than 4 hours	6.00	4.30	Greater than 2 hours
210	8.00	0.30	2.00	5.30	5 to 6 hours	4.00		
211	6.00	1.30	0.30	4.00	4 to 5 hours			
212	6.00	0.30	1.00	4.30	4 to 5 hours	5.00	0.30	Less than 2 hours
213	6.30	1.30	0.05	4.55	4 to 5 hours	4.00		
214	5.10	0.30	0.30	4.10	4 to 5 hours	3.00		
215	6.00	1.30	1.30	3.00	Less than 4 hours	1.00		
MEANS	**6.83**	**0.57**	**0.72**	**5.19**		**5.51**	**2.35**	
MEANS (Interpreted)	7 hours 23 min.	57 min.	1 hour 12 min.	5 hours 19 min.		5 hours 51 min.	2 hours 35 min.	
Std Dev	1.86	0.45	0.87	1.99		2.70	1.82	
MIN	2.00	0.30	0.01	0.30		0.30	0.10	
MAX	16.30	1.30	6.00	13.25		14.00	8.00	

The data in Table 2 is an abridged version of the full data set used in this study. The full data set is downloadable from the Open Science Foundation platform (at https://osf.io/6k7fa/?view_only=ebb824afc1e848428a48351ec3e2864c)

The results in Table 2 reveal a mean sleep duration of 5 hours and 19 minutes which falls short of all the recommended ranges earlier displayed in Table 1. This implies that mathematics education students in Nigeria have insufficient sleep. Figure 9 shows the categories of sleep duration among students of mathematics education in Nigeria.

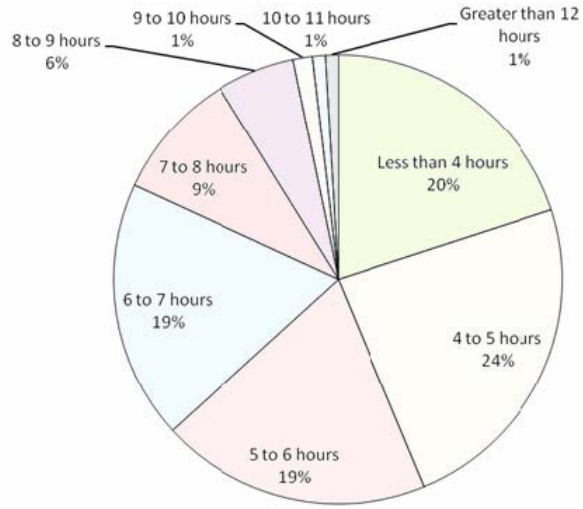

Figure 9. *Categories of Sleep Duration among mathematics Education students in Nigeria.*

7.6. Research Question Six

What is the level of sleep deficit among mathematics education students in Nigeria?

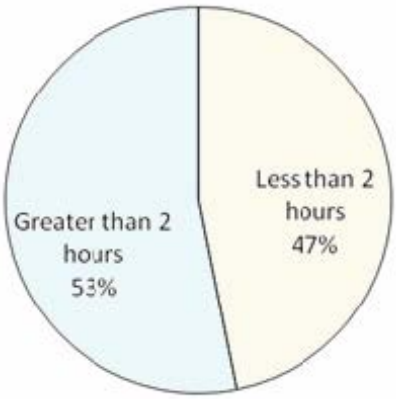

Figure 10. *Categories of Sleep deficiency among mathematics education Students in Nigeria.*

The data in Table 2 shows that students of mathematics education students in Nigeria have a sleep deficit of 2hours and 35 minutes. The pie chart on categories of sleep deficiency reveals that a larger proportion (53%) of mathematics education students have sleep deficit greater than 2 hours, a cause for concern when compared to expected ranges below 2 hours.

7.7. Research Question Seven

What proportion of mathematics education students in Nigeria considered the option of seeing a counselor about sleep related problems?

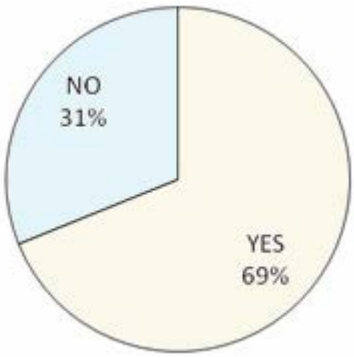

Figure 11. *Proportion of Mathematics Education Students who thought about seeing Counselor about Sleep Related Problem.*

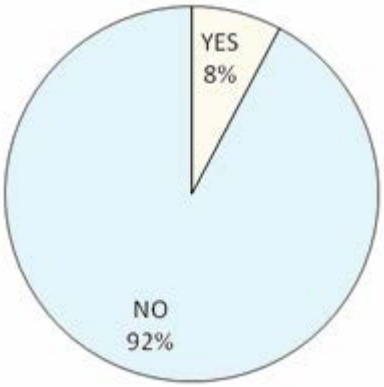

Figure 12. *Proportion of Mathematics Education Students who actually Considered Counseling about Sleep-related Problems.*

8. Discussion

8.1. Use of Electronic devices shortly before bedtime

The outcome of this study has revealed that a high number of mathematics education students in Nigeria use Smartphone, laptops and TVs in the last hour before going to bed. This use of light-emitting digital devices shortly before bedtime has adverse effect on sleep quality. Cain and Gradisar (2010) suggests three likely routes linking digital media to sleep, namely direct displacement of sleep by media use, for instance getting involved in digital activities and staying up late to complete it; heightened physiological arousal associated with the use of digital media close to bedtime, for example playing an exciting game on a smartphone; and bright screens affecting physiological markers that are linked to sleep, such as melatonin. Although the results from analysis of data in research questions one and two does not conclude causality, earlier studies like that of Tavernier and Willoughlay (2014) did conclude that students with sleep problems spend more time using digital media.

The results in Figures 2 to 6 indicate students of mathematics education in Nigeria are spending more time on social media, TV games and computer games. These outcomes agree with the findings of Orzech, Grandner, Roane & Carskadon (2016) who observed that a longer duration of digital media use was associated with reduced total sleep time and later bedtime. When considered alongside Figure 1, the results emerging from this study of mathematics education students in Nigeria affirm that activities in the last hour before bedtime play great roles in digital media's effect on sleep, with computer work, surfing the internet and using digital devices for other purposes showing the strongest relationship to multiple sleep variables (Orzech *et al.*, 2016). These findings, when taken in the light of the statistics in Table 2, add to the evidence that the use of light-emitting electronic devices before bedtime prolongs the time it takes to fall asleep, delays the circadian clock and perpetuate sleep deficiency, resulting in adverse impacts on performance, health and safety (Chang, Aeschbach, Duffy & Czeister, 2015). Similar outcomes were reported by Fuller, Lehman, Hicks and Novick (2017) and Kubiszewski, Fontaine, Rusch and Hazourd (2014) who established that electronic media use by students are associated with impaired sleep quality and late bedtimes. The adverse impact of electronic use on sleep quality has also been linked to availability of high speed broadband internet in recent years (Billari, Guintella & Luca, 2017).

The mathematics education students used in this study, evidently, spend a large amount of time during the day and at bedtime using electronic devices. Daytime and bedtime use of electronic devices are both related to sleep measures with an increased risk of short sleep duration, long sleep onset latency and increased sleep deficiency (Hysing *et al.*, 2015). For

undergraduates with serious school work, these risks translate into grave consequences for academic progress. The attendant sleepiness during the course of a school day has an impact on their learning, focus and memory (Huamani & de Castro, 2014; Agbo-Egwu, Abah & Anyagh, 2017). When students lose sleep, they disrupt their sleep cycles and their bodies respond by decreasing their ability to concentrate and complete complex tasks (Otenyo, 2015).

8.2. Nighttime Phone Location and Sleep Quality

The result of this study has revealed that 79% of mathematics education students in Nigeria have their phones very close to themselves every night. Consequently, 34% of the students wake up more than once to attend to prompts, notifications and calls on their smartphone, a proportion far above the 10% reported for secondary school teenagers in the same region as this present study (Sanya *et al.*, 2015). This pattern of phone location and night awakenings contribute to increase in wake after sleep onset (WASO) time thereby reducing the quality of sleep the undergraduates get at night. The students covered in this survey have a mean WASO time of 1 hour and 12 minutes, and a reported peak WASO time of 6 hours (Table 2). These statistics about phone location are in tandem with the findings of Exelmans and Van den Bulck (2016) who report that six out of ten (60%) Flemish adults took their mobile phone with them to the bedroom, interactively engaging with the device after lights out and thus experienced longer sleep latency, worse sleep efficiency, more sleep disturbance and more daytime dysfunction. Similar outcomes are reported by Kawada *et al.* (2017) who observed that in the cases when night sleep would almost start, phone calls could come from some person, with 102 students of 537 soon responding to it, whereas 200 checked the call bud did not respond and felt in sleep. The observed poor sleep quality have been established through hierarchical linear regression to predict affect the next day (Van Zundert *et al.*, 2015).

The pattern of night awakening displayed in Figures 8 points to bad sleep quality which has consistently been associated with the mobile phone use and a number of devices in the bedroom (Bruni *et al.*, 2015). Earlier works by Amra *et al.* (2017) indicate that adjusted binary and multi-nominal logistic regression models showed late-night call users were 1.39 times more likely to have a poor sleep quality than non-users. Proper sleep hygiene is important in optimizing sleep and minimizing sleep deficit. The bedroom should only be used for sleep, and consequently, students should ensure televisions, personal electronic devices and other blue-light distractions are turned off at night or removed from the bedroom.

The findings on nighttime phone location and night awakening also re-echo the survey results of the Headmaster's and Headmistress' Conference - HMC (2016) which reports that almost half (42%) of students keep their

phone next to their bed at night. 68% of students in the HMC survey admits that using their mobile devices at night affects their school work while a quarter of students (25%) also say they feel tired during the day because of how often they wake up to use their mobile device at night. In this same vein, Lee, Wuertz, Rogers and Chen (2013) observed that compared to the good sleepers, the poor sleepers reported more daytime sleepiness, depressive symptoms and physical symptoms, indicating that sleep disturbances are significant predictors for depression.

8.3. Sleep Quality of Mathematics Education Students in Nigeria

The mean sleep duration of 5 hours and 19 minutes observed from students in this survey is a long way below all known recommendations for normal sleep. This short sleep duration translates to a sleep deficit of 2 hours and 35 minutes and all its attendant implications for the mental well-being of mathematics education students in Nigerian universities. Considering that sleep hygiene is a modifiable risk factor for positive and mental aspects of health, the result presented in Table 2 supports the report of Peach, Gaultney and Gray (2016) that poor sleep hygiene yields significant direct and indirect effects on both depression and subjective well-being. These outcomes are also in consonance with the findings of Spiekinyte *et al.* (2016) who conclude that two-third of medical students reported less the 7 hours of actual sleep and every third student rated subjective sleep quality as poor with an associated lower level of academic achievements. Similarly, de Araujo *et al.* (2013) reports a sleep duration of 6.3 hours among Brazilian College students along with 54% of students presenting poor subjective sleep quality. Evidently, after students transit from secondary schools to university, the outcomes of this present survey has indicated that the border line night time sleep duration earlier reported by Sanya *et al.* (2015) has deteriorated into tangible sleep deficiency, a real cause to worry for the nation's higher education. Similar reasoning can be inferred in comparing the findings of this study to that of Maduabuchi *et al.* (2014) across all sleep characteristics presented in Table 2.

Although this present study did not correlate sleep quality to academic achievement in terms of grade point averages, similar studies have reported that academic performance was significantly associated with nocturnal sleep time, sleep latency and sleep disorders (Reisi *et al.*, 2017). Since academic performance entails the overall well-being of an individual with respect to prescribed tasks (Abakpa, Abah & Agbo-Egwu, 2018), it is not far-fetched that sleep deficiency, which is known to reduce concentration, is a predictor. Relatedly, Mirghani *et al.* (2015) report that a significant difference between the excellent and average groups of medical students in Sudanese universities was found for overall sleep quality, subjective sleep rating, bedtime later than midnight, sleep latency and daytime dysfunction, with the mean sleeping hours (7 ± 1.9) and (6.3 ± 1.9) for the groups respectively. A much earlier

study emphatically concluded that many college students are at risk for sleep disorders, and those at risk may also be at risk of academic failure (Gaultnev 2010).

In this study, 53% reports sleep deficiency of 2 hours and above (Figure 10). This particular outcome agrees with Schlarb *et al.* (2017) who report that more than one-third (36.9%) of German university students reported poor sleep, moderately correlating with anxiety, depression and somatic complaints. This finding taken in the context of other result in this study showed that sleep is a key factor that cannot be over looked, considering the association between insufficient sleep and poor mental health, longer time spent on social media and more frequent engagement of problem behaviour (Kristjansson, 2017; Abakpa, Abah & Agbo-Egwu, 2018). Obviously, with the liberty enjoyed in university education comes the responsibility and the need to blend lifestyle with learning and moderate all other factors towards a befitting academic performance.

9. Implications for Counseling in Higher Education

Centres for Counseling and Human Development (CCHDs) are gradually becoming integral components of higher education management in Nigeria. In every university, the CCHD is saddled with the responsibility of guiding and counseling students on both academic and non-academic issues in the course of their stay in the higher institution. Staff of CCHD takes note of counseling needs of students, right from the initial registration session with the Centre and subsequent referrals from Departments and Faculties as well as personal scheduled and unscheduled visits. By convention, all staff of the university who has regular contacts with students are required to look out for possible indicators of distress such as sudden changes in emotions, repeated requests for special considerations and sudden change in academic performance manifested via lower grades, unexplained absences from classes, loss of motivation for academic work or participation in class and sleepiness in class.

Often, sleep problem can start if the student becomes worried about not sleeping, and this in turn can make it more difficult to sleep. The Student Counseling Service (2012) observes that students become caught in a vicious cycle similar to the diagram in Figure 13.

Disturbed sleeping can be described as one or all of the following:

- Difficulty getting off to sleep
- Difficulty staying asleep e.g. waking several times in the night around 2am or 3am.
- Waking early
- Managing to sleep, but on waking, not feeling refreshed.

(Student Counseling Service, 2012)

Consequently, for a student to be described as an "insomniac" (a student suffering sleep disorder), their sleep difficulty has had to have occurred on 3 or more nights per week and for this to be the norm for them for at least 6 months (Student Counseling Service, 2012). The student in this condition obviously requires counseling. But more often than not, students tend to be reluctant about seeking help for sleep problems as revealed by the results of the study. The outcome in the pie chart in Figures 11 shows that 69% of mathematics education students considered the option of seeing a counselor about sleep related problems, while Figure 12 indicates that only 8% of the students actually consulted counseling while on the university campus. This finding supports Zochil and Thorsteinsson (2018) who reported that high levels of depression, anxiety and stress were significantly associated with decreased sleep quality or decreased help seeking intention.

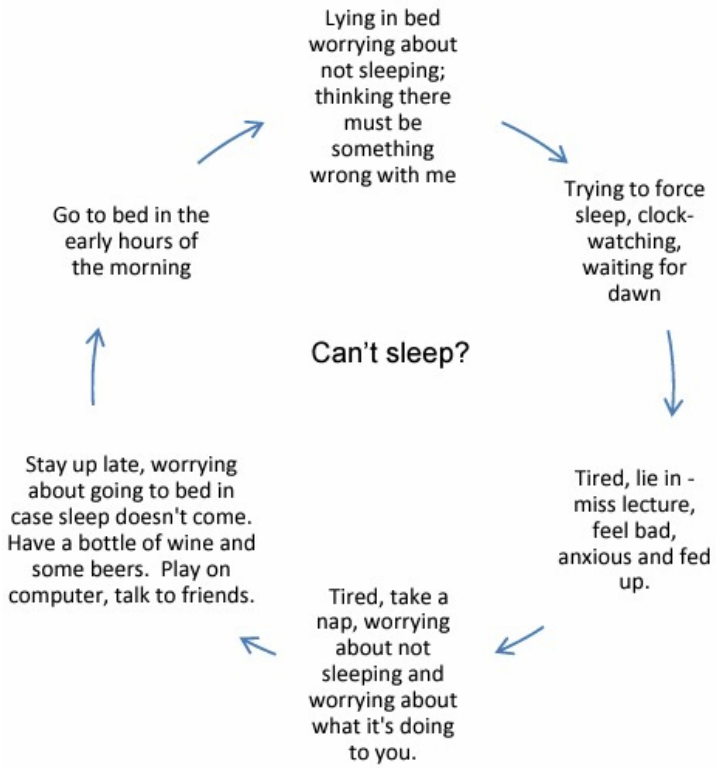

Figure 13. *The Vicious Cycle of sleep problem (Source: Student Counseling service, 2012)*

The outcomes on low level of student consultation of university counseling service with respect to sleep related problems, however contradicts the findings of Pheko, Chilisa, Balogun and Kgathi (2013) who found that Botswana University students had moderate intentions of seeking psychological help. The results, however, agree with Brown, Qin and Esmail (2017) whose outcome show that 80.6% of do not seek help for sleep problems though sleep problems are widely reported. Another study by Qin and Brown (2017) also found that only 18.9% of university students living in residence sought help about sleep problems after 66.8% indicated sleep deficiency.

In the face of such widespread reluctance in accessing professional support, counselors and members of staff of higher education should offer students the opportunity to discuss their reasons and concerns. Some students may be reluctant to talk to a counselor or doctor but may be willing to talk to a student adviser, an examination officer or a chaplain. It is important to discuss the various support options available to them. Faculties who directly observe symptoms of poor sleep habit in students may disclose to them in trust how worried they are about the students' academic potential being thwarted by sleep related problems and other form of distress. Students with sleep deficiency can always get simple pieces of advice such as avoiding reading, watching TV, playing on their laptop or speaking on the phone while in bed. Further methods to enhance sleep provided by Oelschlager (n. d.) and National Sleep Foundation (2000) can be recommended.

The work of CCHD on the university campus is often divided into remedial and preventive interventions (Gilbert & Weaver, 2010). All too often, campus counselors assess the sleep habit of a client only if depression is reported by the student or suspected by the psychologist. If this is not the case, Gilbert and Weaver (2010) note, many counselors neglect asking about sleep habits, even if academic functioning is part of the client's presenting problem. This approach is problematic in itself, considering that many of these non-depressed students will have poor sleep quality and further, it is highly probable that such poor sleep quality will negatively impact their academic functioning. A safer approach will be that university counselors routinely assess the sleep habits of all clients, but especially of those struggling academically. Gilbert and Weaver (2010) suggested that if poor sleep appears to be problematic or contributory to presenting concerns and/or academic functioning, clients should be provided with patient education about the importance of sleep, be given information on sleep hygiene and be encouraged and helped to improve their sleep habits.

Preventive interventions for students affected by sleep related problems is necessary in view of research outcomes showing that lack of insight is a barrier to help seeking as a person needs to be aware there is problem that requires intervention in order to make the decision to seek help (Zochil &

Thorsteinsson, 2018). Awareness campaigns aimed at improving insight to accurately identify poor sleep quality are recommended. CCHDs perhaps in collaboration with health services, should provide psycho-educational information aimed at educating mathematics education students in Nigeria about the importance of good sleep quality for academic success and providing advice on how to achieve it. Other research results have highlighted the need for curricular and extra-curricular education and counseling about healthy sleep patterns (Alfakhri *et al.*, 2015). Such prevention efforts may entail the integration of sleep education into relevant ongoing general studies courses.

10. Conclusion

This study has examined the pattern of sleep characteristics of mathematics education students in Nigeria along with their counseling seeking intention. The sleep variables were considered with Nigeria's rapidly growing technology penetration in mind. The theoretical foundation of the study was grounded on the restoration theory of sleep. After a consideration of related empirical studies from within and outside Nigeria, it was established that although evidences abound on the sleep patterns of diverse demographic categories from Nigeria, very few studies considered specific measurement of sleep variables. In this sense, this study contributes to the existing body of sleep research evidence from Nigeria, particularly in terms of the non-medical approach to sleep study.

The findings of this survey strengthen the idea of a global sleep crisis, with university students in Nigeria worst hit. The dismal sleep duration of 5 hours and 19 minutes observed in this study could be viewed as a time-bomb waiting to explode. Although the study did not correlate sleep quality to any student attainment index, the links to mental health, physical well-being and academic achievement are well rooted in available literature. Hence the need for effective and efficient university counseling service.

Centres for Counseling and Human Development (CCHDs) of higher educational institutions in Nigeria need to brace up for the task of providing proactive, remedial and preventive interventions to students with respect to sleep related problems. Like their counterparts in many developed countries, Nigeria CCHDs must draw serious attention to the prevalence of sleep deficiency among students and its attendant consequences on their general well-being. As a matter of urgency, the ramifications of sleep hygiene should be included in counseling booklets and manuals issued to students during the compulsory registration with the centres on entry in the university.

Calls have also been made for the inclusion of sleep studies in both curricular and extra-curricular programmes of Nigerian universities. Campus-wide campaigns will spread the message on the importance of sleep to health

and the need to seek help where consistent problems with sleep are noticed. Such information programmes can be networked among universities in Nigeria to conglomerate into a national programme of the Federal Ministries of Education and Health.

The depth of this study can be considered a scratch on the surface of a behemoth societal problem. The outcomes of the study are, in a way, intended to spur interest in the study of sleep in Nigeria using more methodical approaches. This effort from a non-medical standpoint is an indication of the versatility of research needed to defuse the sleep time-bomb in the country. As a matter of fact, despite the robustness of this present study, a wide range of gaps exists for future studies to cover. A more detailed study may choose to control for other variables that are extraneous to sleep effects and determine exact impact on the academic achievement of higher education students. The relationship of quality sleep with other problem behaviours among Nigerian students and youths can also be examined by future researchers.

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Appendix A: Technology Usage and Sleep Pattern Questionnaire (TUSPQ)

Course Option: B.Sc.(Ed.)…… Sex:…… Reg. No.:……
(This information will be held confidential. Only needed for correlational purpose)

Technology Usage and Sleep Pattern Questionnaire (TUSPQ)

1. How many of the listed electronic devices do you use in your bedroom the last hour before going to sleep? (Please tick [√] accordingly. Tick as much as you use)
   [ ] Personal Computer [ ] Laptop [ ] Smartphone
   [ ] MP3 Player
   [ ] Tablet [ ] Game Console [ ] TV

2. Outside school hours, how much time do you usually spend on the following during weekdays?
   TV-games [ ]No time [ ]Less than ½ hour [ ] ½ hour to 1 hour
   [ ]2-3 hours [ ] 4 hours [ ]More than 4 hours

   Computer games [ ]No time [ ]Less than ½ hour [ ] ½ hour to 1 hour
   [ ]2-3 hours [ ] 4 hours [ ]More than 4 hours

   Social Media (Chatting) [ ]No time [ ]Less than ½ hour
   [ ] ½ hour to 1 hour [ ]2-3 hours
   [ ] 4 hours [ ] More than 4 hours

   Writing and reading emails [ ]No time [ ]Less than ½ hour
   [ ] ½ hour to 1 hour [ ]2-3 hours
   [ ] 4 hours [ ]More than 4 hours

   Using PC (or Laptop) for other purposes [ ]No time [ ]Less than ½ hour
   [ ] ½ hour to 1 hour [ ]2-3 hours [ ] 4 hours [ ]More than 4 hours

3. When do you usually go to bed on a normal weekday? (e.g: 10:15pm)
   Please specify……

4. When do you usually get up from the bed on a normal weekday? (e.g: 6:15am)
   Please specify…….

5. While in bed for sleep, how long does it take you to actually fall asleep?
   [ ]More Than 60 Minutes [ ]Less Than 60 Minutes

6. If you wake up in the middle of sleep, how long does it take you to fall back to sleep?
   Please specify (in minutes or hours)……..

7. If you have your way, how much sleep do you think you need to feel really rested?
   Please specify (hours and minutes)……

8. Where do you usually put your phone when you go to sleep?
   [ ]Under your pillow [ ]On your bed [ ]Next to your bed
   [ ]In your bedroom but not close to your bed [ ]In another room
   [ ]Other (Please specify)…….

9. On a typical night, after you have fallen asleep, how often do you awaken and check your phone for something other than checking time?
   [ ]Never [ ]Once [ ] 2 times [ ] 3 times [ ] 4-5 times []6-8 times [ ]More than 8 times
10. Do you think you should talk to a professional (Guidance Counselor) if you have Sleep Problems? [ ]YES [ ]NO
11. Have you ever consulted a professional Counselor about sleep issues before?
    [ ]YES [ ]NO
    {If YES, How many times?.....}

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