UNIVERSITI PUTRA MALAYSIA

RELATIONSHIP BETWEEN COGNITIVE PERFORMANCE, ACADEMIC PERFORMANCE, AND SLEEP QUALITY WITH BEDTIME MOBILE PHONE USE AMONG UNDERGRADUATE STUDENTS IN A PUBLIC UNIVERSITY IN MALAYSIA

DARNISHA DEVI A/P RAGUPATHI

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By

DARNISHA DEVI A/P RAGUPATHI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

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Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman : Prof. Normala binti Ibrahim, MB Bch BAO, MMed (Psych), PhD
Faculty : Medicine and Health Sciences

In the present time, technology plays a huge role in every individual's life with an immense increase in its usage that enables an individual to access almost anything and everything at their fingertips. A form of addiction has been seen and mobile phone use accounts to the highest form of technology usage among the other available technology devices. Young adults are the majority group of individuals who are actively seen to be involved in excessive usage of mobile phone specifically during nocturnal hours in their bedroom. This has caused a huge burden to young adult's life in relation to their cognitive performance, academic performance, and sleep quality. The purpose of this research is to examine the relationship between cognitive performance, academic performance, and sleep quality with bedtime mobile phone use. This study was conducted among 385 undergraduate students at Universiti Putra Malaysia, Serdang based on a multistage design that involved stratification and random number sampling procedure. The two strata were Year 1 and Year 2 of study. The faculties, courses, and number of undergraduate students were chosen based on random number selection procedure with regards to the listed criteria. Data was collected using computerized test as well as paper and pencil test. Pearson's correlation was used to analyse the relationship between the variables and hierarchical multiple linear regression was used to identify the significant contributors to bedtime mobile phone use. Statistical Package for Social Science (SPSS)® Version 25 was used to perform statistical analysis.

Respondents had an overall good cognitive performance and academic performance. However, out of 385 respondents, 328 (85.2%) respondents had poor sleep quality. Findings of this study showed that out of 385 respondents, 211 (54.8%) respondents had high frequency of bedtime mobile phone use. The results obtained has disclosed that only academic performance and sleep quality

was significantly correlated with bedtime mobile phone use. The hierarchical multiple regression analysis showed that academic performance and sleep quality were the significant predictors of bedtime mobile phone use. Poor academic performance and poor sleep quality collectively predicted higher frequency of bedtime mobile phone use. Cognitive performance did not predict bedtime mobile phone use. This study provides evidence to young adults of their rate of dependence on mobile phone specifically at night. It brings them awareness of the importance of positive sleep habits that could reduce their dependence on mobile phone at night. Besides that, this study provides preventive measures and early identification of the problematic behaviour as such as poor academic planning that is characterised in an increase in their need to use mobile phone during bedtime for study purposes. This study highlights the role of young adults, public health authorities and policy makers, school community, parents, and device technologist to target issues and negative impacts of undesirable bedtime mobile phone use.

Abstrak tesis yang dikemukakan kepada senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

HUBUNGAN ANTARA PRESTASI KOGNITIF, PRESTASI AKADEMIK, DAN KUALITI TIDUR DENGAN PENGGUNAAN TELEFON BIMBIT WAKTU TIDUR DALAM KALANGAN PELAJAR SARJANA MUDA DI UNIVERSITI AWAM DI MALAYSIA

Oleh

DARNISHA DEVI A/P RAGUPATHI

Januari 2020

Pengerusi : Prof. Normala binti Ibrahim, MB Bch BAO, MMed (Psych), PhD
Fakulti : Perubatan dan Sains Kesihatan

Pada masa kini, teknologi merupakan aset yang penting dalam kehidupan manusia yang membolehkan individu untuk mengakses hampir setiap perkara di hujung jari sahaja. Pembangunan teknologi telah mewujudkan satu bentuk ketagihan dimana telefon bimbit dikenali sebagai jenis teknologi yang digunakan secara berleluasa antara golongan belia khususnya pada waktu tidur. Tingkah laku ini telah menyebabkan beban yang besar berhubungan dengan prestasi kognitif, prestasi akademik, dan kualiti tidur golongan belia. Tujuan penyelidikan ini adalah untuk membincangkan hubungan antara prestasi kognitif, prestasi akademik, dan kualiti tidur dengan penggunaan telefon bimbit waktu tidur. Kajian ini telah dijalankan dengan 385 pelajar sarjana muda di Universiti Putra Malaysia, Serdang menggunakan teknik persampelan rawak berlapis yang melibatkan stratifikasi dan prosedur pemilihan nombor rawak. Kedua-dua strata yang diggunakan untuk kajian ini adalah Tahun 1 dan Tahun 2 pembelajaran. Fakulti, kursus, dan pelajar sarjana muda telah dipilih berdasarkan prosedur pemilihan nombor rawak dengan mengambil kira kriteria-kriteria yang telah ditetapkan. Ujian berkomputer dan borang soal selidik diggunakan untuk mengumpul data. Korelasi Pearson dan regresi linier berganda hirarki dijalankan meggunakan Statistical Package for Social Science (SPSS)® Versi 25.

Responden mempunyai prestasi kognitif dan akademik yang baik secara kesuluruhannya. Walau bagaimanapun, daripada 385 responden, 328 (85.2%) mempunyai kualiti tidur yang tidak memuaskan. Kajian ini menunjukkan, 211 (54.8%) responden daripada 385 responden mempunyai kekerapan penggunaan telefon bimbit yang tinggi pada waktu tidur. Selain itu, kajian ini juga mendedahkan bahawa prestasi akademik dan kualiti tidur sahaja mempunyai perkaitan yang berkadar langsung dengan penggunaan telefon bimbit waktu

tidur. Regresi linier berganda hirarki telah menunjukkan bahawa prestasi akademik dan kualiti tidur adalah peramal penting penggunaan telefon bimbit waktu tidur. Prestasi akademik yang kurang memuaskan dan kualiti tidur yang tidak baik meramalkan peningkatan kekerapan penggunaan telefon bimbit waktu tidur. Kajian ini menghasilkan bukti kepada golongan belia berkenaan kadar pergantungan penggunaan telefon bimbit waktu tidur. Justeru itu, ia membawa kesedaran terhadap kepentingan tabiat tidur yang positif yang boleh mengurangkan pergantungan telefon bimbit waktu tidur. Selain itu, kajian ini menyediakan langkah-langkah pencegahan dan pengenalan awal tingkah laku yang bermasalah seperti kekurangan perancangan akademik yang menyumbang kepada peningkatan keperluan penggunaan telefon bimbit. Kajian ini menekankan peranan golongan belia, kementerian kesihatan, pihak sekolah, pihak berkuasa kesihatan, ibu bapa, dan pakar alatan teknologi untuk mengendali isu dan kesan negatif penggunaan telefon bimbit waktu tidur.

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I would like to dedicate this work to two most important people in my life. Firstly, my late father, Mr Ragupathi Rathakrishnan whom I have never had the chance to meet from his departure but have always felt his presence and blessings from above. I would not have been where I am today or what I am today without my mum, Mrs Janagi Ragupathi, who have played the role of a mum and dad all my life. My dreams of excelling in education would have been mere dreams if it were not for my mother's support and unwavering perseverance in making sure I achieve it. I am thankful for life for the most priceless blessing in my life, my mother.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Normala binti Ibrahim, MB Bch BAO, MMed (Psych), PhD
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Tan Kit Aun, PhD
Senior Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

Beatrice Ng Andrew, MD, MPM
Medical Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

_____
ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 8 October 2020

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I hereby confirm that:

- this thesis is my original work;
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This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
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Signature: _____
Name of Chairman of Supervisory Committee: _____

Signature: _____
Name of Member of Supervisory Committee: _____

Signature: _____
Name of Member of Supervisory Committee: _____

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LIST OF ABBREVIATIONS

SMS	Short Message Service
WI-FI	Wireless Fidelity
MCMC	Malaysian Communications and Multimedia Commission
CANTAB	Cambridge Neuropsychological Test Automated Battery
VRM	Verbal Recognition Memory
VRMIRTC	VRM Immediate Recognition: Total Correct
VRMDRTC	VRM Delayed Recognition: Total Correct
RVP	Rapid Visual Information Processing
RVPPH	Probability of Hit
GPA	Grade Point Average
PSQI	Pittsburgh Sleep Quality Index
UPM	Universiti Putra Malaysia

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

At the present time, technology has become an integral part of an individual's daily life. The advancement of technology has brought a great influence on the human communication and the mobile phone is one the most prominent and conventional usage of technology. Mobile phone is commonly used as a platform for communication through calling and Short Messages Service (SMS). It also has features to aid with daily tasks such as, it functions as alarm clock, reminder, and storage of personal data. Mobile phone is described as a device or a digital telecommunication that enables one user to communicate with another user. According to the Ministry of Finance Malaysia, out of 30 million of Malaysian population, there are approximately 21 million of mobile phone users with an expected progressive rise in the number of users over the years. Mobile phone is said to have the highest number of users as compared to other technological devices (Nagel, 2013).

The young adults are said to have the highest rate of active involvement in the world of technology especially in the usage of mobile phone (MCMC, 2015). Corresponding to the United Nations definition of young adults, they are defined as a cohort of individuals aged from 20 years old to 24 years old (Thomée, Härenstam, & Haqberg, 2017). The usage of this device has become vital among university students as it accommodates to their need to seek for information and assist with their educational needs. Besides that, it serves a distinct purpose of use such as the applications which provides them access to instant communication and social media for free at any point of the day with the availability of wireless fidelity (WI-FI) (Al-Barashdi, Bouazza, & Jabur, 2015).

Individuals tend to spend an extensive amount of time using mobile phone especially at nocturnal hours in their bedroom (Roberts, Petnji Yaya, & Manolis, 2014; Gamble, et al., 2014). Bedtime mobile phone use is defined through the constant usage of the device few nights per week within the hour before bed (Fossum, Nordnes, Storemark, Bjorvatn, & Pallesen, 2014). It is also defined with the use of mobile phone while in bed during the hours before sleep and hesitancy to switch off the mobile phone during bedtime (Kim, 2015; Rowlinson, 2016). Bedtime mobile phone use is determined by the frequency of sending and/or receiving text messages and calls at least once a week after lights out (Exelmans & Bulck, 2015). With the new trendsetting use of technology especially mobile phone usage during bedtime, it has caused a huge burden to young adult's life in relation to their cognitive performance, academic performance, and sleep quality (Kubiszewski, Fontaine, Rusch, & Hazouard, 2013).

Cognition is known as the act of knowing, knowledge or perception. Neisser (1967) has defined cognition as the mental process whereby the external input or the internal input is transformed, reduced, elaborated, stored, recovered, and used (Brandimonte, Bruno, & Collina, 2006). They also added that cognition involves variety of functions such as memory coding, attention, decision-making, planning, and executing actions. The light emission by the mobile phone at night has a direct influence on the cognitive performance of an individual. It results in inattention, decreased levels of cognitive performance as such as poor memory and distraction during class (Sano et al., 2015).

Academic performance is defined by the student's past semester grade point average (GPA) and the expected GPA of the ongoing semester. The GPA is used by tertiary educational institution to measure the academic performance of a student (Shelton & Pedersen, 2015). A higher time spent on mobile phone during bedtime affects the academic performance of a student as they have troubles concentrating in class due to disrupted sleep in terms of time taken to fall asleep, awakening time, and tiredness during the day (Peiró -Velert, Valencia-Peris, González, García-Massó, Serraañó, & Devís, 2014).

Sleep of an individual is also disrupted when they are awakened in between sleep by the mobile phone notifications which replaces the sleep time that affects the sleep quality (Rabiu, Muhammed, Umaru, & Ahmed, 2016). Sleep quality is a subjective assessment of a "poor" sleep or "good" sleep of an individual (Buysse, 2014). An individual sleep quality is influenced by the changes in their sleep pattern which is demarcated by the difficulties falling asleep, staying asleep, early awakening, and sleep that is chronically non-restorative (Siebern, Suh, & Nowakowski, 2012). This could result in primary insomnia disorder in the long run which is defined by the prevalence of an individual's account of troubles with sleep (Roth, 2007). The Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM-4; American Psychiatric Association, 2013) have defined primary insomnia disorder based on certain criteria's which includes difficulty initiating or maintaining sleep, non-restorative sleep for at least 1 month, and sleep disturbance that leads to distress or impairment in daytime functioning in either social, occupational, or other areas of functioning (Siebern et al., 2012).

This study explores the possible associations between cognitive performance, academic performance, and sleep quality with bedtime mobile phone use among young adults.

1.2 Problem Statement

According to the Ministry of Finance Malaysia, the penetration of mobile phone technology is significantly high in Asia with a total of (46%) of smartphone users among the total population of mobile phone users in the world (Kandasivam, 2016). In addition to that, out of the 30 million of Malaysian population, there are approximately 21 million of Internet users and the mobile phone penetration rate

is said to be (143.8%) with an expected progressive rise in the number of users over the years. Mobile phone is said to have the highest number of users as compared to other technological devices (Nagel, 2013).

According to Malaysian Communications and Multimedia Commission (MCMC), approximately 85% of Malaysians are owners of mobile phone in which they have reported that the highest rate of mobile phone users are the young adults (MCMC, 2015). A past study on mobile phone use among students and its relationship to psychological health has revealed that university students spent an average of 6 hours daily on their mobile phone (Zulkefly & Baharudin, 2009).

The gradual change in increase of mobile phone use among students and its higher engagement at night has become a concern as it has an adverse effect and complications on the individual's sleep quality, cognitive performance, academic performance, physical health, psychological health, emotional, and social well-being.

Bedtime mobile phone use can affect the sleep quality of an individual. Students are often seen engaging with their mobile phone during bedtime due to their busy schedule throughout the day (Gupta et al., 2016). The use of this device at night reduces the melatonin production which is responsible for sleep and wake cycles (Mohammadbeigi et al., 2016). Apart from that, mobile phone use at night results in difficulty falling asleep, short sleep duration, and difficulty waking up (Gupta et al., 2015; Munezawa et al., 2011; Schoeni, Roser, & Röösli, 2015).

A poor sleep quality has a significant impact on the cognitive and academic performance of an individual. Sleep is important as it aids in learning process and memory consolidation before and after learning (Schoeni et al., 2015). Students are inclined to excessive bedtime mobile phone use which results in tiredness and difficulty waking up. Due to the feeling of fatigue and other mood conditions, it affects their cognitive performance (Cajochen et al., 2011).

According to Gupta, Garg, & Arora (2016) an increased frequency in missed class, decline in study habits, and decline in grades as well a significant increase in delayed time to arrive for class is seen among student's due to the mobile phone use during bedtime. This results in a decline in the academic performance as the overall performance and concentration affects the functioning throughout the day (Al-Barashdi et al., 2015; Aman et al., 2015; Aung, Nurumal, & Zainal, 2016; Rabiu et al., 2016).

Studies have indicated that mobile phone use during bedtime causes headache and affects areas of the human body that are vulnerable to thermal such as eyes and testes which results in formation of cataracts and a decline in sperm count due to the acute exposure hazards (Kumar, Dawn Chii, Chuan Way, Jetly, & Rajendaran, 2011; Zarghami, Khalilian, Setareh, & Salehpur, 2015).

Bedtime mobile phone use has a direct impact on the psychological health of an individual. Past researches have conducted studies to examine the relationship between these two factors and have found that students who are inclined to late-night mobile phone use are prone to experience psychological disturbances (Gupta et al., 2015; Zulkefly & Baharudin, 2009). Students are more likely to experience depression, anxiety, and low self-esteem. Due to sleep deprivation from the night-time mobile phone use, mood is often disturbed, which leads to an inability in managing stress, regulating behaviour, having increased conflicts with family and peers, and resulting in depressive state (Adams, Daly, & Williford, 2013).

1.3 Significance of Study

The use of mobile phone these days has no limit and its dependence is highly increasing. It has become a major concern for the users due to its faulty and excessive use, especially among the young adults who have the highest rate of engagement with mobile phone. The young adults are an important figure as they are the future to the society and community as well as they play a major role in leading, making important decisions, and constant change to the country. The young adults being the most dependant individuals towards mobile phone would cause an impact in varying ways as such as to themselves, their family, a change in the norms of the society, and affects the future of a country as the next young leaders.

It is vital to perform this study as this issue is understudied. Most studies have focused on the use of mobile phone during the day with its effects on psychological aspects, academic performance, and sleep quality, with minimal study that focused on bedtime mobile phone use (Cajochen et al., 2011; Gamble et al., 2014; Gupta et al., 2016). The present study focuses on a reversal direction of the factors that predicts bedtime mobile phone use. The findings of this study are useful for early identification of this underlying issue as well as it contributes to new knowledge for future preventive actions. It provides knowledge of the importance of an appropriate use of this device and a broader understanding to the rate of dependence of bedtime mobile phone use.

The preventive measure is crucial as it helps the young adults to set boundaries for the availability and engagement of their mobile phone use especially at night and in bed (Schoeni et al., 2015). For an instance, individuals would be provided with information on the importance of healthy sleeping habits and minimizing the late-night mobile phone use by setting a certain limitation for technology use at home and during bedtime (Adams et al., 2013).This information would also be beneficial to parents and device technologist as it provides guidance and support on the control of usage. With information on the negative use of this device during bedtime being laid out, public health prevention strategies could be employed as well as universities could help in promoting the importance of sleep hygiene through workshops. They could present ways to encourage positive

behaviours in academic planning and to enhance cognitive performance while minimizing the negative bedtime mobile phone routine among the young users.

This study explored the relationship between cognitive performance, academic performance, and sleep quality with bedtime mobile phone use. Through the results obtained, a baseline data is provided towards altering the addictive behaviour of mobile phone use at night, early identification of the effects, and addressing the issue which contributes to new knowledge for future preventive actions of the bedtime mobile phone use among the young adults.

1.4 Research Questions

1. What is the number of mobile phone activities and duration of time spent on mobile phone activities during bedtime among undergraduate students in Universiti Putra Malaysia?

2. What is the level of cognitive performance (attention and verbal memory), academic performance, and sleep quality among undergraduate students in Universiti Putra Malaysia?

3. What is the frequency of bedtime mobile phone use among undergraduate students at Universiti Putra Malaysia?

4. What is the relationship between cognitive performance (attention and verbal memory), academic performance, and sleep quality with bedtime mobile phone use?

5. Are cognitive performance (attention and verbal memory), academic performance, and sleep quality the significant predictor of bedtime mobile phone use?

1.5 Research Objectives

1.5.1 General:

To examine the relationship of cognitive performance, academic performance, and sleep quality with bedtime mobile phone use among undergraduate students at Universiti Putra Malaysia.

1.5.2 Specific:

1. To describe number of mobile phone activities and time spent on mobile phone activities during bedtime among undergraduate students in Universiti Putra Malaysia

2. To describe: (a) level of cognitive performance (attention and verbal memory); (b) academic performance (GPA); and (c) sleep quality among undergraduate students in Universiti Putra Malaysia

3. To describe frequency of bedtime mobile phone use among undergraduate students at Universiti Putra Malaysia

4. To examine the relationships between: (a) cognitive performance (attention and verbal memory); (b) academic performance (GPA); and (c) sleep quality with bedtime mobile phone use among undergraduate students in Universiti Putra Malaysia

5. To examine whether cognitive performance (attention and verbal memory), academic performance (GPA), and sleep quality would predict bedtime mobile phone use among undergraduate students at Universiti Putra Malaysia.

1.6 Alternate Hypotheses

H_{1a}: There would be a significant relationship between cognitive performance (attention) and bedtime mobile phone use among undergraduate students in Universiti Putra Malaysia

H_{1b}: There would be a significant relationship between cognitive performance (verbal memory) and bedtime mobile phone use among undergraduate students in Universiti Putra Malaysia

H_2: There would be a significant relationship between academic performance (GPA) and bedtime mobile phone use among undergraduate students in Universiti Putra Malaysia

H_3: There would be a significant relationship between sleep quality and bedtime mobile phone use among undergraduate students in Universiti Putra Malaysia

H_{4a}: Academic performance would explain variance in frequency of bedtime mobile phone use among undergraduate students at Universiti Putra Malaysia over and above cognitive performance (attention and verbal memory).

H_{4b}: Sleep quality would explain variance in frequency of bedtime mobile phone use among undergraduate students at Universiti Putra Malaysia over and above cognitive performance (attention and verbal memory) and academic performance.

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BIODATA OF STUDENT

Darnisha Devi was born on 30th December 1993 in Klang, Selangor. She obtained her primary education at SRK (P) Methodist Klang and her secondary education at SMK (P) Methodist Klang. She then pursued her tertiary education at SEGi University College and graduated with Bachelor of Science (Honors) in Psychology from Upper Iowa University in 2016. With the passion in the field of psychology, she started her scientific research in Master of Science under the supervision of Assoc. Prof Dr. Normala Ibrahim, Dr Tan Kit-Aun, and Dr Beatrice Ng Andrew under Psychiatry Department at Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Her research is directed towards effects of technological device use and well-being outcomes focusing on cognitive functioning, academic performance and sleep.

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