



## **Mediating Effects of Mobile Phone Use on the Relationship between Mobile Addiction and Academic Behavior**

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Since there is little research on the mediative effect of excessive mobile phone use on mobile addiction and academic behavior among university students, hence, the current study sought to study the relationship between these three variables. Data was collected from 435 university students through an online Google form survey sent through a WhatsApp link. Overall, the result shows that that level of mobile addiction was moderate. More than 40% of the respondents had experienced the impact of excessive use of mobile phone while more than 16% experienced negative academic behaviour. Besides, structural equation model fit and measurement models were used to analyze the data with a two-stage structural equation modelling. The first stage involved the assessment of measurement model or also known as Confirmatory Factor Analysis (CFA) for negative academic behavior, excessive mobile phone use and mobile addiction. The measurement model achieved a good fitness index where, RMSEA = 0.064, NFI = 0.9, CFI = 0.932, TLI = 0.921, and Relative Chi-square (Chisq/df) = 2.855. In the second stage of assessment of the structural equation model, the study confirmed that excessive mobile phone use mediates the relationship between mobile addiction and negative academic behavior among students in higher education in Malaysia. The novelty of this study lies in the exploratory analysis of these three variables with a systematic method to find a conclusive result. In summary the findings imply that higher education institutions need to have better guidelines to regulate mobile phone use among students in higher learning institutes.

**Keywords:** academic behaviour, college students, excessive mobile phone use, mobile addiction, university students

**Citation:** Chan, Y. F., Narasuman, S., & Selamat, N. (2022). Mediating effects of mobile phone use on the relationship between mobile addiction and academic behavior. *International Journal of Instruction*, 15(3) 483-502. <https://doi.org/10.29333/iji.2022.15327a>

## INTRODUCTION

The Smartphones have become a device that is highly in demand due to its versatile communication, entertainment and utility functions. Smartphones provide high quality performance and quick access to information and entertainment, such as mobile audio and video calls, mobile teleconferencing, sending and receiving emails, and easy access to the internet for different types of users, including students. Obviously, smartphones have made students' lives easier, as they can access their institutional learning platforms on their gadgets through electronic learning (e-learning), and mobile learning (m-learning) as well as access to various knowledge portals (Ali et al., 2018). Student responses to e-modules in lectures were very positive (Sumarmi, Bachri, Irawan & Aliman, 2021). It indicated that digital technology has begun to play a crucial role in determining the important skills required by students (Indrawati, 2021). Besides, the research by Sariyatun, Suryani, Sutimin, Abidin & Akmal, 2021 have also identified the effect of digital learning material on students' social skills in social studies learning. Currently, smartphones have become a compelling learning tool used to enhance teaching and learning in distance education. Its usage ensures flexible course delivery, makes it possible for learners to access online learning platforms, access course resources and interact digitally (Raza et al., 2020). Obviously, these academic sphere and digital learning materials presented through mobile learning have been found crucial to improve students' social skills (Sariyatun, Sutimin, & Akmal, 2021).

Despite the many advantages and benefits of smartphones for students, there are an equal number of disadvantages and negative effects as well. There are many issues that need to be addressed empirically when it comes to students using smartphones in their academic endeavor. The rate of smart phone addiction among younger students had risen steeply in the past couple of years due to over dependency on technology in every aspect, therefore it is imperative to find conclusive data on the beneficial as well as the detrimental effect of smart phones on students' academic performance.

Lepp, Barkley, & Karpinski (2014) in their study of smartphone use among college students found a negative relationship between smartphone addiction and academic performance. However, other researchers (Samaha & Hawi, 2016; Raza et al., 2020) found that smartphone addiction does have a positive influence on satisfaction in life but negative impact on academic performance. In addition, Sánchez-Martínez & Otero (2009) who studied Spanish high school students, identified that intensive smartphone use leads to school failure. Besides these studies, Jacobsen and Forste (2011) also identified the negative influence of calling and texting on self-reported grade point average (GPA) among university students in the United States. In a similar study, Hong, Chiu, & Hong (2012) also identified a close relationship between calling and texting with academic difficulty among Taiwanese female university students. Apart from the above studies, social media access through mobile gadgets was found to have a negative impact on students' self-esteem (Acun, 2020) which in turn could impact academic performance.

Thus far the literature has indicated that excessive smartphone use will distract student learning (Levine et al., 2007). Majority of students surveyed in these studies treated the

smartphone as a leisure device rather than as an educational tool (Barkley & Lepp, 2013; Lepp et al., 2013). Undeniably, smartphones used for leisure has a high tendency to distract learning in class and leads to multitasking (Jacobsen & Forste, 2011; Junco & Cotton, 2011, 2012; Karpinski et al., 2013; Kirschner & Karpinski, 2010; Wood et al., 2012) and task-switching (Rosen, Carrier & Cheever, 2013), both of which are negatively related to academic performance. Looking at the context of mobile phone use and the student's academic behavior, Horwood & Anglim (2018) have also found that an extensive amount of time spent using smartphone can contribute to much regular task switching between device and learning among students. Task switching occurs when students switch between learning and using their mobile phone at the same time. When this occurs in the classroom during lessons it becomes a disruptive behavior leading to poor academic performance.

Both problematic behaviors of multitasking and task-switching have been recognized as contributing factors which are able to decrease the overall achievement of grades among students. Therefore, high rates of smartphone use can be risky to the students, especially if they exhibit obsessive tendencies towards engaging their smartphone (Kwon et al., 2013). These findings support the idea of a time trade-off between smartphone use and learning activities. That is, the time spent on smartphone use is time lost for learning activities. Hence, it can be concluded that smartphone addiction could have a negative impact on students' academic performance. A growing body of literature (see, e.g. Junco, 2012; Junco & Cotton, 2012; Levine, Waite, & Bowman, 2012) has conclusively identified the negative impact of smartphone use on students' academic performance.

In fact, a study conducted by Giunchiglia et al. (2018) has indicated that social media is actually detrimental to students' performance. This is because social media contains enticing and emotive aspects which can draw student's attention towards it. Rozgonjuk et al. (2018), for example, had also discovered that most students who engage their social media during lectures will result in problematic smartphone use and procrastination in performing their academic task as students. For instance, a study from Ophir et al (2009) has found that while studying, most students engage in multi-tasking also known as task switching which mean that they are using social media and instant messaging while listening to academic lectures. This often results in divided attention and a shift in focus away from the primary activity which is the learning activity (David et al., 2015). Since there are not many studies investigating the relationship between excessive smartphone use and academic performance especially in the Malaysian context, there is an urgent need to conduct this study to identify the mediation effect of excessive mobile phone use on the relationship between mobile addiction and negative academic behavior.

Hence, the study endeavors to explore the following research objectives:

1. To describe the level of mobile addiction, impact of excessive mobile phone use and negative academic behavior.
2. To validate the measurement model of mobile addiction, excessive mobile phone use and negative academic behavior.

3. To determine the structural equation model of excessive mobile phone use on mobile addiction and negative academic behavior.
4. To determine the mediation effect of mobile phone use on the relationship between mobile addiction and negative academic behavior.

## **METHOD**

### **Research Design**

The purpose of this study was to study the mediation effect of excessive mobile phone use leading to mobile addiction and negative academic behavior. Thus, this study employed a quantitative research method where a descriptive correlational research design was used to describe these research variables and to identify the relationships between these three identified research variables. Besides, the two-stage structural equation modelling was employed to conduct model fit and measurement model analysis.

### **Sampling and Data Collection**

Using a simple random sampling method, a sample of 435 college students from two tertiary institutions were selected to glean data through a survey questionnaire. Participants were taken from two comprehensive universities in Selangor, one is a public university and the other one is a private university, and all of these students own a smartphone. The data was gathered through the use of a Google Form, and the access was shared with participants through WhatsApp groups.

### **Instrumentation**

The instrument used to measure mobile addiction and the excessive mobile phone use were determined using items adapted from a prior study by Noradilah's study in 2012. The 'mobile addiction' survey contained 9 items and the 'excessive mobile phone use' survey encompassed 3 items. On a 6-point Likert-type scale, respondents indicated the statement to which they agreed, with regards to their mobile phone usage in the past 6 months (1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree, 4 = Somewhat Agree, and 5 = Agree, 6 = Strongly Agree). On the other hand, the survey measuring the construct of 'academic behavior' was adapted from a number past studies such as those from Hoffman (2009), and Amez and Baert (2020). This section of the survey contained 5 items. These items were scored on a 6-point Likert scale of 1 (Strongly Disagree) to 6 (Strongly Agree).

### **Validity and Reliability**

Instrument validation and reliability tests were duly performed to achieve the righteousness of measures and to incorporate a sufficient representative set of items within the questionnaire. Concerning the instrument's validity, two senior educational psychology lecturers were asked to check on the content validity of the items as they were considered educational experts. No items were deleted, but some changes were made to the items' sentence structure in order to improve clarity. Cronbach Alpha

analysis was used to measure the instrument's reliability. The result of the reliability coefficient indexes obtained showed that the Cronbach Alpha values for mobile phone addiction (.859), excessive mobile phone use (.817), and negative academic behaviour (.838) were deemed reliable (Table 1). Hair, Anderson, Tatham, & Black (1998) stated that an alpha with more than 0.70 or higher values would be considered acceptable. Thus, this instrument is deemed to have fulfilled the essential requirement of validity and reliability in a survey study.

Table 1  
Reliability index of the three research constructs

No.	Constructs	No. of Items	Cronbach's Alpha
1.	Mobile phone addiction	9	.859
2.	Excessive mobile phone use	3	.817
3.	Negative academic behaviour	5	.838

The items for the constructs of Mobile Addiction, Excessive Mobile Phone Use and Negative Academic Behavior in this study are listed as follow in Table 2:

Table 2  
Items for the selected constructs in thus study

No.	Constructs	Item No.	Item
1.	Mobile Addiction	MA1	Won't be able to stand not having a smartphone
		MA2	Feeling impatient and fretful when I am not holding my smartphone
		MA3	Having my smartphone in my mind even when I'm not using it
		MA4	Never give up using my smartphone even when my daily life is already greatly affected by it
		MA5	Getting irritated when bothered while using my smartphone
		MA7	Not being able to use my smartphone would be as painful as losing a friend
		MA10	Checking SNS (Social Networking Service) sites like Twitter or Facebook right after waking up
		MA11	Preferring to talk with my smartphone buddies to hanging out with my real-life friends or with the other members of my family
2.	Excessive Mobile Phone Use	NEM3	Experiencing light head ache or blurred vision due to excessive smartphone use
		NEM4	Feeling pain in the wrists or at the back of the neck while using a smartphone
		NEM5	Feeling tired and lacking adequate sleep due to excessive smartphone use
3.	Negative Academic Behaviour	NB1	Using smartphone devices distracted me from doing my classroom assignment
		NB4	I feel sleepless due to over use of smartphone, not my study
		NB5	My academic performance has been interrupted due to the time I spend on the smartphone
		NB6	My grades or homework are interrupted due to the time I spend on the smartphone
		NB7	I waste my time writing / sending SMS during class time

### Data Analysis

The collected data were analyzed with SPSS version 20, and structural equation modelling. Descriptive statistical analysis has been used to describe the levels of

smartphone addiction, impact of excessive mobile phone use and negative academic behavior. Besides, structural equation modelling was used to do model fit analysis and measurement analysis on the three major constructs of mobile addiction, excessive mobile phone use and negative academic behavior. Structural equation modelling (SEM) is a multivariate statistical approach that allows simultaneous examination of interrelated relationships among multiple independent and dependent variables (Hair et al., 2010; Tabachnick & Fidell, 2007). This study employed the two-stage SEM analysis as suggested by Anderson & Gerbing (1998), which is widely used in the context of the current research context (Kaplan, 2000). The first stage involved the assessment of the measurement model or also known as Confirmatory Factor Analysis (CFA) for negative academic behavior, excessive mobile phone use and mobile addiction. The assessment of the measurement model involves the test for the goodness of fit and the assessment of construct validity. In the second stage, the assessment of the structural equation model was conducted to examine the significant effects between the independent variable (mobile addiction), the mediating variable (excessive mobile phone use) and the dependent variable (negative academic behaviour). Guidelines for good fit was applied (Hair et al., 2010) where, convergent validity needs to be considered in the measurement model. Convergent validity indicators require factor loadings to be at least 0.5, and the score of Average Variance Extracted (AVE) to be 0.5 or higher and the construct reliability should be 0.6 or higher.

Table 3  
Summary of the goodness of fit indices

Goodness of Fit Indices	Name of Index	Recommended Threshold	Sources
Absolute fit	Chi-square/Degree of freedom ratio ( $\chi^2/df$ )	$\chi^2/df \leq 5$	Hair et al. (2010)
Incremental fit	Comparative Fit Index (CFI)	$CFI \geq 0.9$	Bagozzi & Yi (1988); Hair et al. (2010)
	Tucker-Lewis Index (TLI)	$TLI \geq 0.9$	Bagozzi & Yi (1988); Hair et al. (2010)
Parsimonious fit	Root Mean Square Error of Approximation (RMSEA)	$RMSEA \leq 0.08$	Browne & Cudeck (1993); Hair et al. (2010)

Next, the goodness of fit indices validates the model as these indices reflect how well the data statistically fits the model. Hair et al. (2010), recommended the use of various goodness of fit indices in determining the model fit. As there are no essential conditions on types of fit indices that are recommended to be used by researchers, thus, Jaccard & Wan (1996), suggest the use of fit indices from different categories. Therefore, the strategy of using multiple indexes as suggested by Jaccard & Wan (1996) could overcome the limitations of using only one index. Following these two scholars' ideas, this study used the three categories of model fit, which are commonly used in the research namely, absolute fit, incremental fit, and parsimonious fit (Hair et al., 2010). The first category of model fit of absolute fit index included normed chi-square ( $\chi^2/df$ ); the second category of model fit involving incremental fit index which consisted of Comparative Fit Index (CFI) and Tucker-Lewis Index (TFI); and finally, the third

category of model fit involving a parsimonious fit index which consisted of the Root Mean Square Error of Approximation (RMSEA). The goodness of fit indices used in this study and their threshold values are as displayed in Table 3.

## FINDINGS

### Respondents

Based on the demographic profile of the respondents as shown in Table 4, majority of the respondents (73.7%, n=334) were female and only 26.3%, n=119 were male. In terms of ethnicity, majority of the respondents were Malays, yielding 72.8% (n=330) of the total number of respondents. This was followed by other ethnic groups 12.0% (n=54), Chinese 8.6% (n=39) and Indian 6.6% (n=30). The students' age ranged from 18 to more than 56 years old throughout the undergraduate and post graduate programs. The highest age distribution of the respondents entailed 18-22 years old, yielding 61.4% of the majority (n=275). The second highest average age group was 23-27 years old, yielding 27.7% (n=124) followed by the age group ranging from 28-32, yielding 2.9% (n=13) respectively. Regarding the level of education, the findings indicated that the highest percentage of respondents are diploma students (44.4%, n=201), followed by bachelor's degree (30.9%, n=140), and *Sijil Pelajaran Malaysia / Malaysian Education Certificate* (SPM) (17.2%, n=78) students.

Table 4  
Demographic profile of respondents

Demographic Profile	Frequency	Percent
<b>Age</b>		
Female	334	73.7
Male	119	26.3
Total	453	100%
<b>Race</b>		
Malay	330	72.8
Chinese	39	8.6
Indian	30	6.6
Others	54	12.0
Total	453	100%
<b>Age</b>		
18-22	275	61.4
23-27	124	27.7
28-32	13	2.9
33-37	7	1.6
38-42	17	3.8
43-47	7	1.6
48-52	3	0.7
53 and above	2	0.5
Total	448	100%

## Descriptive Analysis

### Level of Mobile Addiction

Table 5 reports the mean and standard deviation scores of respondents for mobile addiction. The mean scores for each item were arranged in a descending order to rank the levels of mobile addiction as perceived by students. Results show that students perceived that they acquired a moderate to low level of mobile addiction, which varied from the maximum of 3.96 to the minimum of 2.56. For example, the respondents perceived a moderate level of mobile addiction by admitting that “feeling the urge to use my smartphone again right after I stopped using it (mean = 3.96, S.D. = 1.30)” and “never give up using my smartphone even when my daily life is already greatly affected by it (mean = 3.69, S.D. = 1.30)”. However, the respondents did not really agree that they prefer to talk with their smartphone buddies to hanging out with their real-life friends or with the other members of my family (mean = 2.56, S.D. 1.52). The results show that the overall mean score for mobile addiction was 3.41 (S.D.= 0.89). This means score inferred that the level of mobile addiction was at moderate level.

Table 5  
Level of mobile addiction

No.	Item	Mean	S.E	Level
1.	Feeling the urge to use my smartphone again right after I stopped using it	3.96	1.30	Moderate
2.	Never give up using my smartphone even when my daily life is already greatly affected by it	3.69	1.30	Moderate
3.	Won't be able to stand not having a smartphone	3.66	1.43	Moderate
4.	Checking SNS (Social Networking Service) sites like Twitter or Facebook right after waking up	3.57	1.61	Moderate
5.	Getting irritated when bothered while using my smartphone	3.48	1.35	Moderate
6.	Feeling impatient and fretful when I am not holding my smartphone	3.27	1.38	Moderate
7.	Having my smartphone in my mind even when I'm not using it	2.97	1.36	Moderate
8.	Not being able to use my smartphone would be as painful as losing a friend	2.75	1.45	Moderate
9.	Preferring to talk with my smartphone buddies to hanging out with my real-life friends or with the other members of my family	2.56	1.52	Low
	Overall mean	3.41	0.89	Moderate

Scale: Low (1.00-2.67), Moderate (2.68-4.35), High (4.36-6.00)

### Impact of Excessive Mobile Phone Use

Table 6 reports the frequency and percentage of respondents who experienced excessive mobile phone use. Result in Table 6 shows that 269 respondents (59.4%) felt tired and lacked adequate sleep due to excessive smartphone use, 236 respondents (52.1%) experienced light head ache or blurred vision due to excessive smartphone use and 194 respondents (42.9%) felt pain in the wrists or at the back of the neck while using a



smartphone. These results infer that excessive usage of smartphones have detrimental effects to students' health.

Table 6  
Impact of excessive mobile phone use

No.	Item	Frequency	Percentage
1.	Feeling tired and lacking adequate sleep due to excessive smartphone use	269	59.4
2.	Experiencing light head ache or blurred vision due to excessive smartphone use	236	52.1
3.	Feeling pain in the wrists or at the back of the neck while using a smartphone	194	42.9

### Negative Academic Behaviour

Table 7 reports the frequency and percentage of respondents who responded to their negative academic behavior. Result in Table 7 shows that 191 respondents (42.2%) perceived that using smartphone devices distracted them from doing their classroom assignment and 136 respondents (30.1%) felt sleepless due to over use of smartphone but the use of smartphone was not for their academic purposes. Meanwhile, 106 respondents (23.4%) felt that their academic performance has been interrupted due to the time they spent on the smartphone, 113 respondents (24.9%) felt that their grades or homework were interrupted due to the time they spent on the smartphone and 74 respondents (16.0%) felt that they waste their time writing or sending SMS during class time.

Table 7  
Negative academic behaviour

No.	Item	Frequency	Percentage
1.	Using smartphone devices distracted me from doing my classroom assignment	191	42.2
2.	I feel sleepless due to over use of smartphone, not my study	136	30.1
3.	My academic performance has been interrupted due to the time I spend on the smartphone	106	23.4
4.	My grades or homework are interrupted due to the time I spend on the smartphone	113	24.9
5.	I waste my time writing / sending SMS during class time	74	16.0

### Measurement Model

The measurement model for the underlying constructs is provided with the path diagram as shown in Figure 1. In each of the measurement models, multiple items are used to measure each underlying factor. In order to improve the model fitness, Zainuddin (2014), suggested items with the lowest standardised factor loading or items with factor loading less than 0.5 should be deleted to improve the model fitness. Next, if the model continues to indicate misfit, the measurement model needs to be respecified by removing the redundant items (Hair et al., 2010; Kline, 2011). Parsimonious unidimensional estimation can be achieved by removing the redundant items based on the suggestion by Anderson & Gerbing (1988). The discriminant validity is achieved

when the model and its constructs are free from redundant items. Thus, the pair of redundant items in the model in terms of high modification indices was identified to be eliminated.

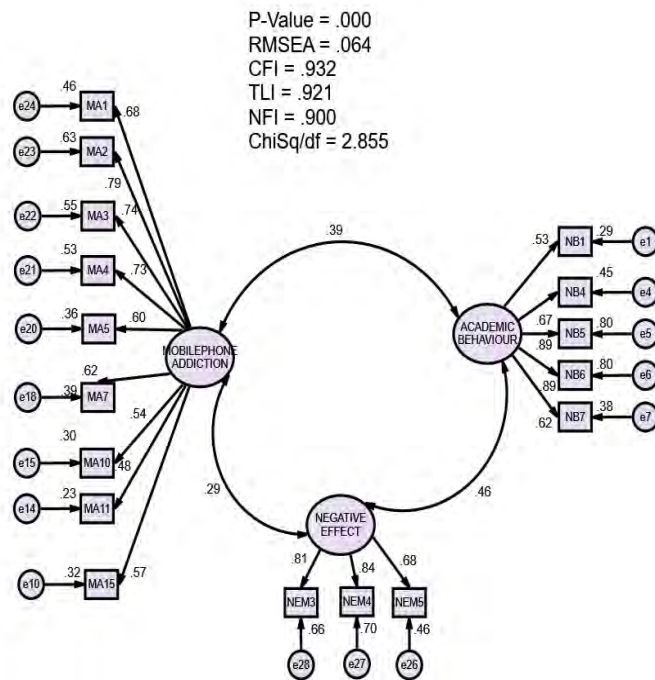


Figure 1

Measurement model of excessive / negative effects of mobile phone use mediates on mobile addiction and negative academic behavior

Prior to running the structural equation modelling, the overall measurement models were assessed in three steps; firstly, all three latent variables with 30 observed variables were entered into the model. Later, a re-specified model was modified and improved to achieve the best model fit. In this step, 13 observed variables were eliminated from the model due to low factor loading value (less than 0.5) and redundant items, namely, MA6, MA8, MA9, MA12, MA13, MA14, MA16, NEM1, NEM2, NB2, NB3, NB8 and NB9. Next, the re-specified model was performed with three variables followed by 17 observed variables. As a result, as shown in Figure 1, the measurement model of this study achieved a good fitness index where the scores of RMSEA = 0.064, NFI = 0.9, CFI = 0.932, TLI = 0.921, and Relative Chi-square (Chisq/df) = 2.855 were acceptable.

Once the unidimensionality of the constructs was achieved, each of the constructs were assessed for their reliability and validity. Table 5 represents the result of Construct Reliability (CR) and Average Variance Extracted (AVE), for the overall measurement

model. The AVE ranged from 0.537 to 0.608 which was above the cut-off value of 0.5 as suggested by Hair et al. (2010). Also, the Composite Reliability (CR) values ranging from 0.822 to 0.849 has exceeded the recommended value of 0.60 for all the constructs as recommended by Hair et al. (2010). Additionally, the factor loadings for all 19 items ranging from 0.48 to 0.89 have met the cut-off value of 0.5 as suggested by Hair et al. (2010). The results in Figure 1 showed the overall goodness-of-fit assessment for the measurement model which indicated that all correlation coefficients among the research constructs were less than 0.90, thus demonstrating a discriminant validity of no redundant items. Hence, this measurement model can be presented as a good model fit with adequate Convergent Validity and Construct Reliability (Bagozzi & Yi, 2012; Hair et al., 2010) as shown in Table 8.

Table 8  
Reliability and validity test for measurement model

Variables	AVE	CR
Academic behaviour	0.54	0.849
Mobile addiction	0.537	0.863
Negative effects of mobile phone use	0.608	0.822

Note: Construct Reliability (CR), Average Variance Extracted (AVE)

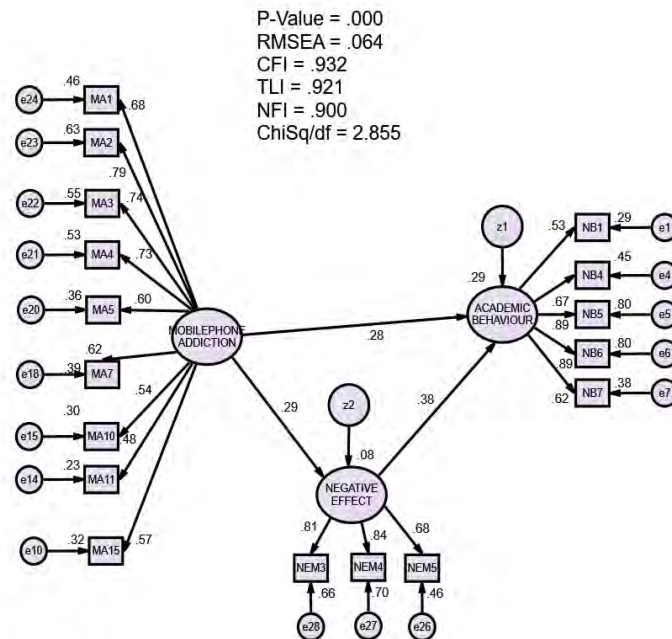


Figure 2  
Structural equation model of excessive mobile phone use on mobile addiction and negative academic behaviour

### Structural Equation Model

In this study, structural equation modelling was used to examine the mediation effect of negative effect / excessive mobile phone use on the relationship between mobile addiction and negative academic behaviour. The structural equation modelling presented in Figure 2 demonstrated a good fitness index where, RMSEA = 0.064, NFI = 0.9, CFI = 0.932, TLI = 0.921, and Relative Chi-square (Chisq/df) = 2.855.

### Mediation Analysis

Bootstrapping method was used in this study to assess the mediation as recommended by Preacher & Hayes (2008) because this method is the most robust and reasonable method for obtaining the confidence limits for the specific indirect effect under most conditions. Furthermore, the bootstrapping method yields a better level of statistical power when bootstrapping the indirect effects (Hair et al. 2010). Thus, bootstrapping was performed using 5000 subsamples with a two-tailed test type and bias correlated and accelerated as a confidence interval method.

The result of bootstrapping analysis in Table 9, Figure 2 and Figure 3 shows that the specific indirect effect ( $\beta = 0.280$ ) was significant ( $p < 0.001$ ) at t-value of 4.945 which was  $> 1.96$ . Additionally, the specific indirect effect of 95% bias-corrected bootstrap confidence interval for this specific indirect effect [LL=0.63, UL=0.172] which did not straddle a 0 in between indicated that a mediation was present. The results revealed that the mediation effect of negative / excessive mobile use on the relationship between mobile addiction and negative academic behavior was statistically significant.

Table 9  
Hypothesis testing on mediation analysis

	Std. Beta	Std. Error	t-value	Confidence Interval	
				LL	UL
MA->NEM->AB	0.280	0.051	4.945***	0.63	0.172

Note: \*\*\* $p < 0.001$ , LL=Lower Level, UL=Upper Level

MA=Mobile addiction, NEM=Negative effect / excessive mobile phone use, AB=Negative academic behaviour

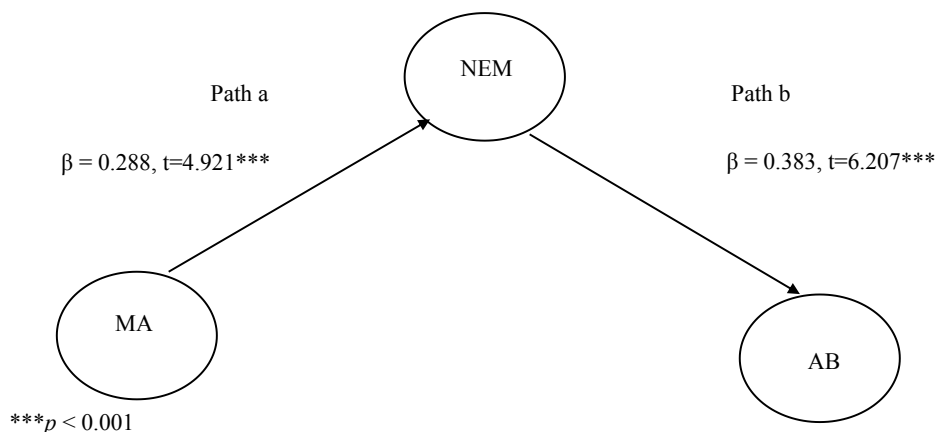


Figure 3

Figure 3

Path analysis of the mediation effect of excessive mobile phone use on mobile addiction and academic behavior

## DISCUSSION

### Mobile Addiction, Impact of Excessive Mobile Phone Use and Negative Academic Behavior

Overall, the result showed that the level of mobile addiction was identified at moderate level which is similar to the findings of Lepp, Barkley, & Karpinski, 2014 and Acun, 2020. The findings of more than 40% of the respondents who experienced excessive mobile phone use and more than 16% who demonstrated negative academic behavior are identical to the studies of Acun, 2020 and Praveeni and Wickramasinghe (2020). All of these current studies showed that varsity students did experience moderate level of mobile addiction, and many students have used their smartphone excessively which has affected their academic performance accordingly. This scenario needs attention from the authorities in the university.

### Structural Equation Modeling Analysis and Mediation Analysis of Excessive Mobile Phone Use on Mobile addiction and Negative Academic Behavior

The measurement model and model fit analysis have verified validity and reliability of the three identified research variables and allows it to proceed to the structural equation modeling analysis. The structural equation modelling analysis in this study has confirmed the mediation effect of negative / excessive mobile phone use in the relationship between mobile addiction and academic behavior with bootstrapping analysis. The result shows that excessive mobile phone use among students can induce mobile addiction and leading to negative academic behavior. To some extent, this result is supported by the study of Tangmunkongvorakul et al. (2019) from Thailand. They

found a negative association between excessive smartphone use and the psychological well-being of university students. In their study, excessive smartphone use was an independent predictor of psychological well-being. The students with excessive levels of smartphone use also derived lower scores on the social-psychological well-being than those who did not use smartphones excessively. Basically, the study of Tangmunkongvorakul et al. (2019) has supported the relationship of excessive mobile phone use and mobile addiction as identified in this study.

The structural equation model validated in this study has also supported the previous study which was conducted by Ahmed et al. (2020) in Pakistan. The purpose of their study was to examine the influence of smartphones on the performance of university students in Pakistan. Their study investigated the functions of the smartphone as exogenous predictors such as smartphone applications, multimedia messaging service (MMS), short message service (SMS), warp-speed processing, and entertainment on the academic performance of students. Their study also addresses the impact of electronic word of mouth (eWOM) and attitude as mediating variables between exogenous and endogenous variables. These researchers from Pakistan incorporated technology and addiction as moderating variables between independent variables and the outcome variable to measure the influence of moderating variables. The findings of their study demonstrate that smartphone functions have a significant influence on students' academic performance which is similar to this study. They also found that moderating and mediating variables also have a significant influence on exogenous and endogenous variables. This is identical to this study where excessive mobile phone use has showed a mediation effect between mobile addiction and negative academic behavior.

The relationship between mobile addiction and negative academic behavior that has been confirmed in the structural equation modelling analysis in this study was also supported by the study of Praveeni & Wickramasinghe (2020). The data was gathered from 315 students from four universities. The scope is limited to management undergraduates in Sri Lanka. In the study of Praveeni & Wickramasinghe (2020), smartphone addiction is defined as the independent variable of the study. However, undergraduates' academic performance is identified as the dependent variable of the study. Technology Driven Multitasking behaviour is considered as a mediator variable. Descriptive and inferential analysis were used while regression analysis was used to test hypotheses. Further, Sobel test was used to test the mediate effect in the relationship between the independent variable and dependent variable.

This study from Sri Langka was designed to examine university undergraduates' level of smartphone addiction and to investigate the impact of smartphone addiction on their academic performance with the mediating effect of Technology Driven Multitasking behaviour. The findings of this study indicated that university students were highly addicted to the use of smartphones. The data analysis from Praveeni & Wickramasinghe (2020) also showed that smartphone addiction negatively impacted on academic performance. Besides, Technology Driven Multitasking Behavior also negatively impacted on academic performance. Furthermore, Technology Driven Multitasking Behavior has also mediated the relationship between smartphone addiction and

academic performance. In fact, the concept of Technology Driven Multitasking Behavior is quite similar to concept of “Excessive Mobile Phone Use” in this study. Hence, the findings of Praveeni & Wickramasinghe (2020) have supported the similar findings of smartphone addiction among the students and its negative influence on students’ academic performance as identified in this study. Besides, the study of Praveeni & Wickramasinghe (2020) has also supported the mediation effect of excessive mobile phone use on the relationship between mobile addiction and negative academic behavior as identified in this study. Overall, this study suggests that the students should reduce the intense use of Smartphones in order to perform well in their academic activities. Overall, the findings of this present study which have been supported by these three previous studies have provided an insight for university policy makers to develop better guidelines to monitor excessive mobile phone use among university students in the context of Malaysian higher learning institutes.

### **CONCLUSION**

Overall, the result shows that that the levels of mobile addiction were moderate. More than 40% of the respondents have experienced the impact of excessive use of mobile phone and more than 16% have admitted negative academic behavior. The structural equation model has confirmed the relationship between excessive mobile phone use with mobile addiction and negative academic behavior. Besides, the mediation analysis has also confirmed the effect of excessive mobile phone use on the relationship between mobile addiction and negative academic behavior. Ultimately these findings provide a clear-cut answer to the relationship between mobile addiction and academic behavior mediated by excessive mobile phone use. Obviously, university students cannot distance themselves from disruptive technologies. The findings in this study have provided evidence that university students are intense multitaskers employing the latest smartphone technologies. With the emerging trend of smart classroom pedagogical concepts in educational environment, multitasking with technologies should be effectively regulated for better academic behavior. The present study has laid down the basic foundations for future researchers to undertake studies concerning the influence of smartphones on student academic performance in the university as the outcome variable.

Based on the findings, it is recommended that students should reduce the use of smartphones and the addiction to it, and prioritize their academic tasks (Hiscock, 2004; Selwyn, 2003). Many educational institutions have restricted the use of smartphones and other technology in the classroom while lessons are on-going, while some institutions have banned cell phones all together or require students to keep them in a separate box by the door to be retrieved at the end of class. Other options include concepts like technology breaks can also be introduced to remove both internal and external distractions whenever students engage in learning. Primary limitation of this study is the sample size of this study which includes only one public and one private universities. This limits the generalizability of the findings to other universities in Malaysia.

This study is also limited to the scope of a few selected variables which includes excessive mobile phone use, mobile addiction and academic behavior. Hence, future research should replicate the present study with other variables such as attitude, and

interpersonal relationship. This study only relies on quantitative data, which is confined to the understanding of the phenomenon in more detail. For future studies, it will be better to use a mixed method and include students for in-depth interviews or case study. Future research can also be conducted by actual measurements in actual time spent on multitasking and task-switching behaviors, through observation or online tracking methods. Further it is recommended, to incorporate different methodologies to analyze mobile addiction from different aspects in various context which will facilitate a strong awareness with regards to effective utilization of technology devices.

In the near future, the most feasible study is to incorporate a more diverse population and engaging in longitudinal studies to determine the variance level of academic behavior. The future research can separate the respondents into two groups, namely: a group of problem students who experience cell phone addiction and use cellphones excessively to identify the relationship with their negative academic behavior, and a group of normal students who do not experience cellphone addiction and do not use cell phones excessively to identify the relationship with their academic behavior. From these results, it will be seen the condition and level of their addiction to cellphones, and how critical is the status of cell phone use which is considered excessive for Malaysian students. These results will confirm the correctness of the relationship between cell phone addiction and excessive cell phone use on students' academic behavior, whether it applies only to students with problems or for both.

#### **ACKNOWLEDGEMENT**

This paper is based on an FRGS research project funded by the Ministry of Education, Malaysia and the Research Management Centre and the Faculty of Education, Universiti Teknologi MARA, Malaysia [Project Code: 600-IRMI/RGS 5/3 (027/2019)] Malaysia.

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