Smartphone Addiction among Young Adolescents: Integration of Flow Theory and Fear of Missing Out

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Keywords	Abstract.
	In the age of terabytes and milliseconds, a pathological use of smartphone is now growing tremendously among adolescents worldwide. This global phenomenon has made smartphone addiction the most popular type of technology addiction. Underpinned by Flow Theory, this study contributes to the body of knowledge on the consumer behaviour towards a psychological perspective on smartphone usage among students in a Malaysian university. A total of 210 students participated in this study. A partial least square structural equation modelling (PLS-SEM) method was applied in testing the hypotheses. The results show that all nine hypotheses tested on antecedents of smartphone addiction were found to be significant. The strongest predictor discovered in the model is concentration, suggesting that users who are addicted spend countless time in using smartphone due to enormous concentration on entertainment and social networking sites that are commonly available in smartphone applications.

1. Introduction

Since the advent of the internet, the main focus has been centered on studies related to technology addiction and its behavioural outcomes, but recent years have shown that the matter is more serious as smartphones come to the fore (see Barnes et al. [5]). Users are not aware and unconscious on their level of engagement with smartphone and cell phone alike (see Roberts et al. [44]). This engagement has led to an overdependence and reliance on smartphone which eventually take over the most important part of human life. The number of people owning mobile phones has increased drastically day by day. Subscribers have reached 4.6 billion in the year 2016 and are expected to increase even

further in the years to come (see Alalwan et al. [2]). The evolution of technology, availability of cheap smartphones and easy access are factors that lead to more people using smartphone in their daily lives. It is an undeniable fact that smartphone has become an important aspect of human life, as the current global phenomenon shows that one has to carry their smartphone wherever they go and one cannot live without it.

As lifestyle becomes more complex and elusive in the way humans interact, smartphone is indirectly changing the way humans live, communicate and socialize (see Chiu, [11] and Anshari et al. [3]). One of the most important elements in a smartphone is internet connection. This feature enables users to search for information, use social media, download music and engage in various other online activities using this device. This makes smartphone more preferred compared to its predecessors, computer and laptop. Smartphone is compact, durable and easily accessible. In fact, it is regarded as an internet-connected computer (see Cao et al. [7]).

With an abundance of hedonic gratifications offered by social networking sites, a prolonged engagement on a smartphone is seen to have led to a severe addiction (see Cao et al. [7]). An excessive use of a smartphone leads to compulsive checking behaviors where individuals are prone to checking their smartphone in a state of unconsciousness. These compulsive disorders are also known as "disconnection syndrome" and "ring or phantom vibration syndrome" (see Marazziti, Baroni and Mucci [39]). This addiction could bring adverse effects on one's mental and physical well-being by inducing negative physiological and psychological effects such as depression and exhaustion (see Luqman et al. [37]). Individuals with low self-esteem, social difficulties, high anxiety levels, marked interpersonal sensitivity, obsessive thoughts, and compulsive behaviours are mostly affected by a smartphone addiction (see Marazziti, Baroni, and Mucci [37]). Therefore, the main objective of this study is to elucidate the in-depth understanding of smartphone addiction among students on their academic performance, reality substitute and time management problem. Taken together, this study is aimed to test the relationship between Flow Theory and the physiological factors of instant gratification, mood regulation and convenience.

2. Literature Review

Traditionally, an addiction is always associated with substance abuse through excessive handling of stimulants and drugs-related materials. The inability of an individual to control their addiction is pertinent to their low self-control of the brain inhibitory mechanism. In the new age of technology, people can become addicted to other non-substance addiction such as sex, gaming, food, shopping and internet (see Cocorada et al. [12]). A more recent addiction is the use of smartphone, where scholars have termed it to be a form of behavioural addiction (see Kwon et al. [34]). Some have termed it as a smartphone addiction (see Samaha and Hawi, [47]), an excessive smartphone usage (see Shen and Wang, [48]), a compulsive smartphone use (see Panda and Jain, [42]), a smartphone attachment (see Trub and Barbot [51]), a smartphone dependence in labelling excessive usage without a formal clinical diagnosis. As smartphone addiction is the common term used by many researchers, it also involves the cognitive capacity of

individual of likelihood of one craving and relapse during abstinence (see Mohamed et al. [40]).

As the internet is becoming easier to access through the means of smartphone, the pattern of addiction in using smartphone has increased tremendously (see Kwon et al. [34]). This addiction has affected all segments of human life and it is more prevalent in adolescents. Adolescents are pleasure-seekers and have the purchasing power in acquiring materials that they desire. They have unique characteristics and behaviours which are very distinct to the older generation (see Eastman et al. [16]). They are born and raised in an epoch of booming technology and using smartphone is considered a norm in their life. This has a significant impact on their engagement with internet especially on social networking sites which impacted on their lives in term of social, cognitive and emotional aspects (see Immordino-Yang et al. [30]).

As smartphones are becoming more convenient to use, equipped with superfast internet and advanced mobile applications, people can simply communicate, shop and even perform day-to-day jobs using smartphones. Furthermore, entertainment is much easier to retrieve and has provided instant gratification and pleasure (see Liu et al. [36] and Zhang et al. [60]). Studies in smartphone and/or mobile addiction have attracted the interest of scholars worldwide. Recent studies have not only studied addiction in smartphone but also addiction in social networking sites (SNSs). SNSs have developed exponentially with the advance of smartphones. People want to keep in contact with others to know their daily life activities and want to be informed almost 24/7 on what their friends are doing (see Blachnio and Przepiorka [6]). Together with smartphones, SNSs have become the perfect ingredient to hook users and eventually make them addicted to its applications. Many studies have linked smartphone addiction to social networking attachment (see Rozgonjuk et al. [46]).

It can be deduced that hedonic motivation is a push factor for an individual smartphone use, but few studies have shown factors that lead to enjoyment in using smartphone (see Chen et al. [9]). Previous studies have included enjoyment as predictor in understanding user's smartphone use, but fail to explain the antecedents of enjoyment (see Gao et al. [22]). Understanding enjoyment in the aspect of student's life in university is important as students are young adolescents who are actively seeking for pleasure and fun. Factors that lead to enjoyment and further addiction to smartphone should be controlled and interventions should be taken by authorities and stakeholders in university to ensure that adverse impacts of smartphone addiction among students can be minimised, controlled, and mitigated through efficient teaching and learning in both classes and campus activities.

2.1. Instant gratification

As a component in desirability-feasibility perspective, instant gratification is able to predict one's enjoyment and concentration towards an exciting activity (see Chen et al. [9]). It is termed as one degree of gratification that individuals engage via impulsive behaviour (see Liu et al. [36]). It is a personality behaviour when an individual is inclined towards a behaviour that is impulsive in nature such as driving, shopping and also playing online games. Instant gratification serves as a positive reinforcement that

contributes to instant satisfaction (see Zhang et al. [60]). As consumers are inclined towards repetitive glance on their smartphone that are equipped with SNSs and various forms of entertainment, their needs of gratification are fulfilled.

Users utilise smartphones to relieve stress by indulging in the immediate gratification it provides (see Lee et al. [35]). Despite that, there are drawbacks to excessive use of it even if it provides instant pleasure to users as users will be diminished into a sense of volitional control and induced persistent activity. This instant reach to smartphone would make users to rely heavily on smartphone even in an unconscious state where they would seemingly use smartphone even the situation is unbecoming such as a hazardous context in driving a vehicle. Students usually would have high instant gratification towards engagement with smartphone. This can be contributed by two factors of trend in technological age: to acquire instant gratification to avoid or escape from academic matters. Hence, the following hypotheses are proposed:

H1: *Instant gratification has a positive influence on student's perceived enjoyment.*

H2: *Instant gratification has a positive influence on student's concentration.*

2.2. Mood regulation

Any addiction will show a certain degree of salience that overcomes to dominate one's feeling and thinking. The addictive behaviour will alter one's mood into experiencing such phenomena (see Panda and Jain, [42]). It is a process where one's mood is altered due to the excitement in using technology. As such, in a case of withdrawal from such behaviour, one would result in unpleasant feeling and frustration. It has shown that mood regulation in technology-adapted behaviour has led to negative consequences and further engendered unfavourable behaviours (see Zhang et al. [60]). This excessive IT usage is a form of negative reinforcement. As in online gaming is multiplayer platform, it was found that players are indulged in gaming to escape from real-life problems (see Khang et al. [32]). It was found that mood regulation is a negatively related cognitive factor that is a consequence of excessive IT usage (see Caplan [8]). Individuals who are anxious may prefer to engage online using smartphone as a mean to diminish anxiety and self-representation in the context of interpersonal settings. As students withdraw from such activities, they would have unstable mood and can possibly have mood alteration. Excessive mood alteration may lead to problematic outcomes that affect the function of emotional and social aspects. It may cause depression, loneliness, anxiety, procrastination and impulsivity. Hence, the following hypotheses would like to test the following relationship between mood regulation and subsequent factors of flow:

H3: *Mood regulation has a positive influence on student's perceived enjoyment.*

H4: *Mood regulation has a positive influence on student's concentration.*

2.3. Convenience

An individual would experience an easiness of flow in using gadget when it is feasible enough for them to use it. If using smartphone needs only small effort and does not

requires hardship, users might experience an enjoyable time and becoming more attentive (see Chen et al. [9]). One would feel more positive outcomes when convenience of using such devices facilitates their purpose. In using something or experience in adapting to a certain environment, one would feel positivity in a state of convenience. In using smartphone, convenience is a predictor that promotes the development of smartphones. When compared with laptop and conventional computers, smartphone is by far a much easier and convenient choice, albeit providing the same features and pleasure of using laptop (see Zhang et al. [60]).

Convenience is rather similar to perceived ease of use. However, convenience, in a more comprehensive definition, is the ease of use that only focus on free of effort. Convenience includes situational factor, for example, the location of IT accessibility. In convenience state, one would be having joy and fun due to its perceived accessibility and easiness. The convenience would entitle one to be taking more concentration due to its feasibility in facilitating task in hand. Hence, the following two hypotheses are proposed:

H5: *Convenience has a positive influence on student's perceived enjoyment.*

H6: *Convenience has a positive influence on student's concentration.*

2.4. Flow theory

Perceived enjoyment and concentration are a subset of flow concept as proposed by Csikszentmihalyi (see Chen et al. [9]) "the holistic sensation that people feel when they act with total involvement and the experience is so enjoyable that people will do it even at great cost, for the sake of doing it" (see Csikszentmihalyi [13] p. 117). Flow Theory is a well-documented concept to explain human behaviour, together with Theory of Planned Behaviour (see Atombo et al. [4]). It is known as the experience in activities within the state of complete absorption in an optimal circumstance. Individuals that experience a state of flow will find an assuring pleasure in their activities that is perceived to be doing. Scholars have developed several concepts of flow, where the two most important antecedents are enjoyment and concentration (see Zaman et al. [59]). Individuals are motivated to engage in activities that have an enjoyable experience before repeating such activities as compared to other non-enjoyable activities. In pursuing such enjoyment, one has to concentrate on said activities by dismissing their mind from other matters (see Csikszentmihalyi [14]). Flow Theory has been studied in many human addiction-oriented studies, including online game addiction (see Wan and Chiou [52]), shopping addiction (see Niu and Chang [41]) and internet addiction (see Yang et al. [57]). Studies shows that Flow Theory is capable in explaining user's addiction towards internet based or supportive system on internet. Hence, explaining student's smartphone addiction using flow theory stands as the main justification on this study's adoption of the theory.

There have been many opinions on the number of variables within the Theory of Flow. According to Guo and Poole [24], flow consists six main variables: concentration, perceived control, awareness, transcendence of self, merge of action and autotelic experience. In another opinion, Hausman and Siekpe [27], flow consists of four domains (concentration, control, enjoyment and challenge), while another perspective laid out that

flow only consists of enjoyment and concentration (see Zaman et al. [59]). In proposing flow as the underpinning theory in this study, perceived enjoyment and concentration will be adapted, as these two mostly studied variables by previous researchers (see Zhang et al. [60] and Chen et al. [9]).

2.5. Perceived enjoyment

Perceived enjoyment is a form of intrusive motivation, particularly when they are motivated to participate in an activity using technology (see Koufaris, [33]). Gao et al. [22] has studied smartphone addiction within three dimensions of enjoyment i.e. escapism, pleasure and arousal. Escapism is a form of action that one makes to engage in a cognitive absorbing activities in escaping unpleasant problems and realities they are facing (Wu and Holsapple, [56]). Pleasure refers to feeling a person experiences either happy, satisfied or good. While arousal is a state where a person is sensory-stimulated and alert while engrossed in a form of action. This study focuses on the enjoyment as a whole where one might use smartphone to escape some depressing realities and also use the smartphone as an arousal purpose in discussing current issues or gossips that might alert their cognitive state. Using smartphone might also serve as a form of pleasure that relieves their stress level after too much focus on academic matters in university. People nowadays use smartphone more than the previous generation because of the entertainment and the satisfaction the smartphones provide. Together with SNSs, consumers use smartphone as hedonic motivator in pursuing enjoyment rather than utilitarian purposes. Many studies have linked enjoyment to individual smartphone addiction and hence, this would be the next hypothesis in this study:

H7: *Perceived enjoyment has a positive influence on student's smartphone addiction.*

2.6. Concentration

Concentration, within the flow theory, explains to understand an individual flow. One's addiction in smartphone usage requires a flow that consumes a hefty time consumption where one spends full and unbroken concentration. For an addiction to happen, one needs to acquire temporal and cognitive concentration on the task at hand. As the concentration intensifies, one can be said to be in a state of addiction (see Chen et al. [9]). Another term for concentration is attention focus (see Zhou and Lu, [61]). It reflects user's immersion in doing something they prefer. Users may often concentrate on smartphone which can lead to harmful consequences, especially on movement. When someone is focusing on using a smartphone in a dangerous place where by right they should focus on a task at hand such as in a subway or while driving, the use of smartphone is shifting their attention focus and experience. Thus, the need to develop in-depth analysis of concentration in smartphone addition is influential in understanding this addictive behaviour.

H8: *Concentration has a positive influence on student's smartphone addiction.*

2.7. Fear of Missing out

Fear of missing out (FoMO) is a concept that delineates to explain one's desire to keep updates on other people's status, while believing that other people experience satisfaction even during one's absence (see Blachnio and Przepiorka [6]). It is also known as the basic motivation of human desiring for attachment with others. It is a pervasive apprehension into thinking others have rewarding time and experience in one's absence. FoMO is one's desire to stay connected with others. This trait is more prevalent in adolescents as they are a group of friends that always stay connected especially on social media and other SNSs. It was also empirically proven that men have more inclination towards FoMO (see Przybylski et al. [44]). One can be agitated, anxious and uneasy in a situation that might be deemed as being left out by their peers. The urge to keep updated would bring adverse impacts on the mental and cognitive states which eventually results in the decline of performance in academic matters, sleep and mental state. Studies on FoMO have focused on depression and anxiety perspectives, however studies connecting FoMO to other psychological aspects are scarce (see Elhai et al. [18]). Hence, this study proposes the relationship between FoMO and smartphone addiction among young adolescents, as this relationship can be described as asymptotic particularly in the era of technology. Therefore, hypothesis number 9 is presented as:

H9: *Fear of missing out has a positive influence on smartphone addiction.*

The 9 hypotheses of the research model are presented in Figure 1.
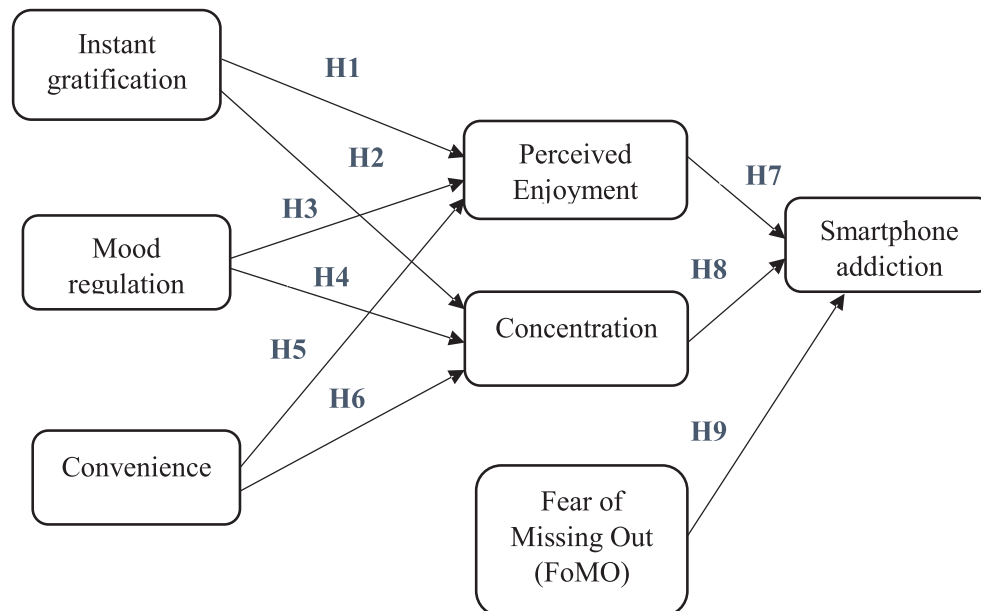
3. Methodology

3.1. Sampling

Figure 1: Research model.

Participants were composed of students hailing from five different regions in Malaysia. The region consists of Northern, Central, Southern, East Coast and East Malaysia. A quota sampling technique was divided into the five regions, consisting of 20 undergraduate students from these five regions. Survey was distributed to 635 students, with a return of 235 accounting to a response rate of 37 per cent. After data cleaning, a final 210 response were analysed.

3.2. Measure development

Smartphone addiction scale consists of 11 items adapted from Hong et al. [12]. It measures 3 components of smartphone addiction scale that include time management problem, academic performance and reality substitute. Items are arranged on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A sample item includes "While using mobile phones, I would think "just give me some more minutes".

Flow dimension consists of perceived enjoyment and concentration. It is adapted from Zaman et al. [59]. Items are arranged on a 5 Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A sample items for perceived enjoyment is "Using smartphone is enjoyable" and a sample item for concentration is "When using smartphone, I am deeply engrossed".

Instant gratification is adapted from Liu et al. [36] and Chen et al. [9]. It is arranged on a 5 point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Sample items are "I use smartphone because it fulfils my needs immediately" and "The reason I use smartphone is to gain immediate gratification". Mood regulation is adapted from Caplan (2010). Items are arranged on a 5 point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Convenience is adapted from Yoon and Kim [58] and Chen et al. [9]. Sample items are "I can use smartphone whenever I want" and "I can use smartphone wherever I am".

Fear of missing out measures are adapted from Przybylski et al. [44], consisting 10 items. It ranges from 1 (strongly disagree) to 5 (strongly agree) on a 5 Likert scale. A sample items includes "I fear others have more rewarding experiences than me".

4. Result and Data Analysis

The demographic information of the respondents is shown in table 1. The percentage of female students is higher than male students with 149 (70.1%) and 61 (29.9 %) respectively. The age shows a range from 19 years old to 25 years old with the highest is 22 years old. Most of the student's family income ranges from the RM4000-RM6000 group, which provides information on the student's ability to own a smartphone. The number of smartphone ownership shows that the majority of students own one smartphone, with only 24 and 6 students owning 2 and 3 smartphones respectively.

4.1. Common method variance

A study that applies a cross-sectional design is a concern for common method bias (CMV) (see Malhotra [63]). For a measurement of CMV, Harman Single Test using

Table 1: Demographic information ($N = 210$).

Categories	Type	Frequency	Percentage
Age	19	2	0.9
	20	49	23.3
	21	37	17.6
	22	79	37.6
	23	30	14.2
	24	11	5.24
	25	2	0.9
Sex	Male	61	29.9
	Female	149	70.1
Family income	Below RM1000	41	19.5
	RM2000-RM4000	92	43.8
	RM4000-RM6000	28	13.3
	RM6000-RM8000	18	8.57
	RM8000-RM1000	15	7.14
	More than RM1000	16	7.62
No of smartphone own	1	180	85.7
	2	24	11.4
	3	6	2.86

Statistical Package for Social Science (SPSS) was applied on the data. A value of 25.716 per cent shows that a single factor contribution to the total variance. Hence, no issue of sample bias from the respondents participated in this study.

4.2. Measurement model

Following a suggested step in reporting PLS-SEM, a measurement model is performed (see Chin [10] and Hair et al. [25]). The elements assessed include factor loading, internal consistency, convergent validity and discriminant validity.

4.2.1. Factor loading

All the items in factor loading that had a score less than 0.7 are deleted (see Hair et al. [26]). Items below 0.65 are deleted except for items Fear7 and Fear9 which is close to 0.65 value. The deleted items include one for convenience, Conv3 (0.581) and six for smartphone addiction of Add5 (0.264), Add4(0.432), Add11(0.535), Add9(0.567), Add6 (0.626) and Add8 (0.647). As for FoMO there were 3 items deleted, Fear8 (0.571), Fear6 (0.606) and Fear5 (0.633).

4.2.2. Construct reliability

For the construct reliability, the value of its internal consistency (denoted by Cronbach alpha and composite reliability) all lies above 0.7, denoting that all the items are consistent in measuring its desired construct. As for average variance extracted (AVE),

all the constructs measured are above its cut-off value of 0.5. Table 2 depicts the construct reliability in this study.

Table 2: Construct reliability.

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Concentration	0.833	0.9	0.749
Convenience	0.734	0.849	0.653
Enjoyment	0.911	0.944	0.85
FoMO	0.845	0.882	0.52
Instant Gratification	0.781	0.872	0.695
Mood Regulation	0.913	0.939	0.793
Smartphone addiction	0.773	0.847	0.526

4.3. Discriminant validity

Discriminant validity is assessed by the Hetrerotrait-Monotrait ration of correlation (Henseler et al 2015). The desired value is expected to be below than 0.90 as a requirement to ensure that these constructs are distinct from each other (see Fauzi et al. [20] and Teo et al. [50]). Previously, literature had used Fornell-Larcker Criterion to assess the discriminant validity, but recent discovery, strengthened by empirical evidence suggests that HTMT is enough and provided a better explanation of construct discriminant validity than Fornell-Larcker (see Hair et al. [26]).

HTMT analysis shows that no HTMT value exceeds 0.90, indicating that this study does not experience a discriminant validity issue, hence it would be safe to conclude that all the constructs are different to each other in measuring respondent's true feedback. Table 3 shows HTMT ratio of correlation analysis.

Table 3: HTMT ratio of correlation.

	CONT	CONV	ENJ	FEAR	GRA	MOO	ADD
CONT							
CONV	0.504						
ENJ	0.541	0.715					
FEAR	0.343	0.111	0.249				
GRA	0.565	0.704	0.715	0.222			
MOO	0.476	0.379	0.476	0.216	0.571		
ADD	0.802	0.434	0.503	0.569	0.586	0.421	

CONT= concentration, CONV=Convenience, ENJ=enjoyment, FEAR=fear of missing out,
GRA=instant gratification, MOO=Mood regulation, ADD=Smartphone addiction.

4.4. Structural model

The relationship and hypothesis testing results between the variables are shown in Table 4. The results show that all the nine hypotheses proposed in this study are supported. The path coefficient (β-value) ranges from 0.121 to 0.505. The highest path coefficient is found to be from H8, concentration towards smartphone addiction, and this suggests that concentration would be the leading cause of addiction among students. As for the effect size, the lowest effect is enjoyment on smartphone addiction with 0.024, passing the threshold for it to be considered to have a minimal effect on the model (0.02 for small effect). In determining the decision of the hypotheses, a t-value of more than 1.645 for a two tailed significance level is assessed, supported by the conventional p-value of less than 0.05. In relation to the path coefficient, H7 having the lowest t-value, just passed the required significant level of 1.992. Other paths show a significant level having passed the 0.01 and 0.001 level.
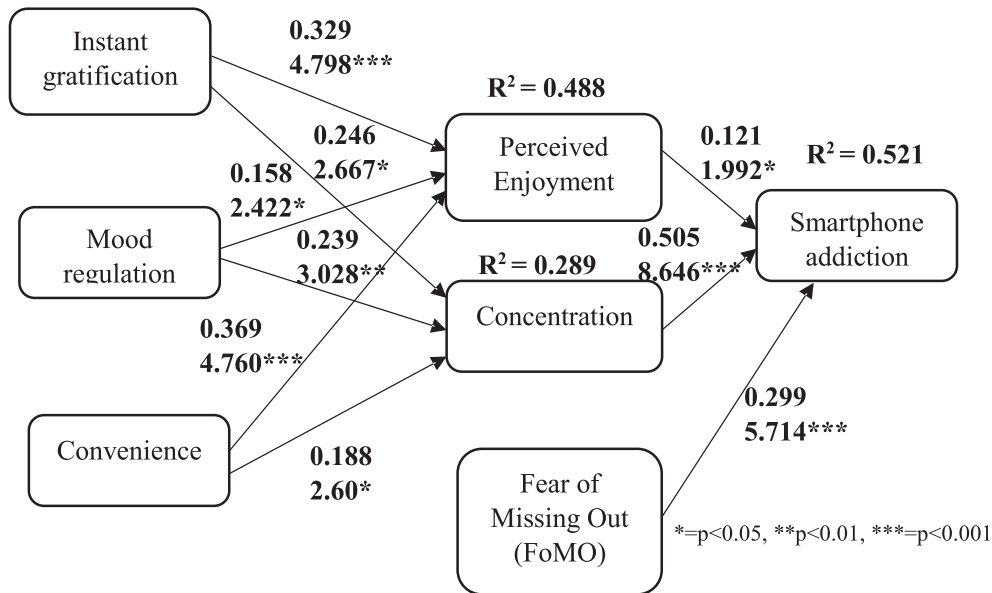

Figure 2: Result of structural model.

5. Discussion

5.1. Instant gratification

As students require instant and rapid pleasure, using a smartphone can be an immediate pleasure and gratification. The path coefficient of instant gratification towards enjoyment is 0.329, showing a strong correlation with effect size of 0.126 which has a substantial effect. Hence, H1 is supported and it is consistent with other studies (see Zhang et al. [60] and Chen et al. [9]). As for instant gratification on concentration, a slightly lower path coefficient of 0.246 is observed with an intermediate effect size of

Table 4: Result of hypotheses testing.

	β-value	f^2	t-value	p-values	Decision
H1: Instant gratification→Enjoyment	0.329	0.126	4.798	0	Supported
H2: Instant gratification→Concentration	0.246	0.05	2.667	0.008	Supported
H3: Mood regulation→Enjoyment	0.158	0.037	2.422	0.016	Supported
H4: Mood regulation→Concentration	0.239	0.06	3.028	0.003	Supported
H5: Convenience→Enjoyment	0.369	0.189	4.76	0	Supported
H6: Convenience→Concentration	0.188	0.035	2.6	0.009	Supported
H7: Enjoyment→Addiction	0.121	0.024	1.992	0.047	Supported
H8: Concentration→Addiction	0.505	0.395	8.646	0	Supported
H9: FOMO→Addiction	0.299	0.17	5.714	0	Supported

0.05. Thus, H2 is also supported with a significant t-value of 2.667. The significance of instant gratification on concentration is supported by other studies such as in Zhang et al. [60] and Chen et al. [9]. As students are bogged down with heavy academic workload, escaping from it to have something stress-free or an activity that they can turn to is considered to be temporarily satisfying. Instant gratification is important for user's usage of device and technological gadget in today's world as it is relevant to the current generation's application of smart technology.

5.2. Mood regulation

Mood regulation was found to be significant on both enjoyment and concentration, thus supporting H3 and H4. The path coefficient was 0.158 and 0.239 respectively showing an intermediate and strong correlation. This is supported by previous studies that found mood regulation had positive influence on enjoyment and concentration (see Zhang et al. [60] and Chen et al. [9]). Among the two dependent variables, enjoyment is perceived to be positive while concentration is perceived to be negatively associated with human behaviour. The outcome shows that students pay too much concentration on smartphone which lead to negative outcomes such as depression, anxiety and stress as reported by Caplan [8].

Smartphone addiction behaviour will alter one's mood, in a way that the experience will alter the mood towards certain engagement (see Panda and Jain [42]). As mood regulation leads to enjoyment, students would prefer to engage in smartphone usage to escape from reality they are experiencing in their academic life which is perceived as real-life problems (see Khang et al. [32]). As it gets one away from intense stress in academic and curricular matters, it is considered to be positive on individual's psychological perspective. In contrast, it can be considered as a form of a negative reinforcement when the students withdraw from using smartphone, although excessive mood swing will occur as an implication from such withdrawal.

5.3. Convenience

Convenience was found to be positively influencing on both enjoyment and concentration, thus supporting H5 and H6. The path coefficient was found to be 0.369 and

0.188 respectively. The effect size on the other hand shows a strong and weak effect on the model respectively with 0.189 and 0.035. Smartphones help students to accomplish many responsibilities that were not possible back in the old days (see Suki [49]). From just the ease of using a small rectangular device, people are able to purchase online, share information and even check in a hotel. This convenience features have made human day-to-day chores become easier and more convenient. Due to this convenience, people are able to feel a sense of enjoyment and fun. Getting away from stressful academic life, turning to gadget that conveniently facilitates their online matters would be perceived as applicable and effective in student's day-to-day activities. Apart from that, being convenient, students tend to concentrate on its application just a bit it too much, which may cause severe consequences to their addiction.

5.4. Perceived enjoyment

Perceived enjoyment explains the variance of R2 value is found to be 48.8 It is much stronger that concentration which suggests that students use smartphones with the need and pursuit for enjoyment. Students perceive that by using a smartphone their problems can be alleviated, which partially true depending on their actual duration spent on smartphones. The relation between perceived enjoyment and smartphone addiction is found to have a path coefficient that is substantially weak and lower than concentration. This explains that when students enjoy using smartphones, they do not experience the adverse impacts of smartphone addiction such as the decline of academic performance and bad time management. The significant relationship is also in consistent with other studies (see Zhang et al. [60] and Chen et al. [9]).

5.5. Concentration

Concentration was found to have significant impacts on smartphone addiction, with path coefficient of 0.505, the strongest relation among all the hypotheses. The effect size of 0.395 and significance t-value of 8.646 show that it is substantially strong effect to the model and construed as the most impactful relationship on smartphone addiction. Several studies have also documented concentration as a strong predictor towards smartphone addiction, as found in Chen et al. [9]). This concentration on smartphone can create a massive dependence on its function as well as absorbing the positive and negative consequences. Park [43] noted that the dependence can be categorized into functional and existential dependence. Functional dependence is a positive dependence where one would depend on the functions that the smartphone can provide in assisting task and responsibilities, while existential dependence is defined as an obsession and unconscious engagement. Relatively, existential dependence is an attribute that users need to overcome and diminish, as it will affect student's academic life. The concentration of students will be shifted too as a result of depending on the existence of smartphone. Eventually, adverse psychological impacts can be associated with the excessive smartphone usage.

5.6. Fear of Missing out

As a new dimension in understanding student's excessive usage of smartphone in university, FoMO has been found to be significantly affecting smartphone addiction usage. The path coefficient of 0.299 is considered to be close to have a strong impact on smartphone addiction. An effect size of 0.17 shows that the effect size of FoMO is medium. The significance level is also at the 0.001 level showing a strong significant correlation. There have been many documented studies that have strongly linked negative consequence of fear of missing out to problematic and excessive smartphone use (see Elhai et al. [17]), and have been associated with excessive usage by students in campus (see Przybylski et al. [44]). Students are burdened with a huge amount of academic loads. Being a young adolescent, one of the best ways to escape from such pressures is to turn their attention to the excitement and entertainment provided by the software and social networking sites provided by a smartphone. As the sample included a big proportion of female students, it has shown that female is more prone to smartphone excessive usage as supported by Wang et al. [53].

6. Implication

Smartphone usage has changed the landscape of human behavioural traits. As more people are very much dependant on smartphone in their daily life routine, susceptible measures have to be taken to mitigate any possible negative impacts of excessive smartphone usage. This study delineates the implications from theoretical and managerial perspectives.

6.1. Theoretical

This study contributes to the body of knowledge in the area of consumer behaviour with regard to smartphone usage. Firstly, within the scope of Flow Theory, it reveals that humans focus on vocations and activities that are deemed important through perceived enjoyment and convenience. Previous studies had applied Flow Theory in explaining behavioural usage of smartphone (see Jin et al. [31], Zhang et al. [60] and Chen et al. [9]). Among the two variables in Flow Theory, concentration has the strongest path correlation. This explains that when students concentrate on their smartphone, they are prone to be engaged within a certain period of time. The time consumed and concentration absorbed within the phone utilization has created a vacuum of engrossment and excessive engagement among students in institutes of higher learning.

Secondly, this study has linked fear of missing out as an important antecedent of smartphone addiction. This had been discussed in previous findings as in Wolniewicz et al [55] and other studies linking FoMO to technology addiction (see Dempsey et al. [15]). Individual's reluctance in missing out on social events is more prevalent in adolescents and students in higher education. Peer influence is very strong in that it has created fear of not being able to cope with other progresses. As FoMO is a person's result related to unmet social needs, it can be associated to other various psychological perspectives such as depression and social anxiety (see Wegmann et al. [54]). The concept of FoMO was only coined in 2013 and it is still relatively new in explaining user's addictive behaviour,

especially in smartphone usage. In short, this study has contributed new insights in the area of technological behaviours, and more work can be pursued in this line of study.

6.2. Managerial

This study outlines managerial implication from three perspectives. Firstly, the impact of smartphone addiction can be detrimental to social and psychological development of young adolescents. Even though using smartphone in today's time is considered as a norm, the extend of using it without proper self-control and self-determination would pose atrocious impact to many parties. Needless to say, addiction to gadget and technology is harmful for the students themselves, as it can affect the future of the nation as students today would become the future leaders and nation builders. Having them in mode of addiction would be harmful to nation building and development. Hence, sharing the harmful impacts of smartphone addiction should be inculcated and disseminated. The academics must play a pivotal role in sharing the knowledge and promoting physical interaction rather than virtual interaction.

The number of students owning more than one smartphone is considered to be significantly high. Considering this, it can be concluded that the number of smartphone ownership will increase with time. Several smartphones are used for different purposes, as students use each phone for different needs and purposes. A probable increase of smartphone ownership will affect the way users utilize their time. An effective intervention should be done in order to reduce over-dependence of smartphone. One way is to enhance knowledge on the detrimental impact of smartphone through knowledge sharing (see Fauzi et al [20] and Ghazali et al. [23]). Knowledge sharing should be inculcated in universities by integrating it in the curriculum on the impact of prolonged and excessive use of smartphone on students (Fauzi et al. [19]). Faculty members and administrative staff that have experience in dealing with students should engage and utilize their knowledge and experience in curbing the harmful impacts of excessive smartphone usage. A more technical method is to apply a technical measure, such as proposed by Mahmoudi et al. [38] on using time metric based on simple exponential smoothing model. University authority can monitor students who are connected via the university Wi-Fi on the amount of time they spend online. Also, students that have problem in academic matters can be checked in their time metric using this method.

Next, the implication on curricular structure in higher education on pedagogical method of teaching is mandatory. Today's generation is far different from the baby boomers and the generation X where the conventional method of pedagogy is considered to be more compatible with the old generation. Having smartphones as a physiological need to human cognitive and physical need requires different method of teaching in class. Academics have to be critical and creative in engaging students in class. One of the methods is engagement with game learning such as gamification and interactive communication between lecturers and students. Smartphones should be integrated in class activities and could possibly adapt assignment and task via social media using smartphone (see Ahmed et al. [1]).

Within the scope of smartphone marketing, there is a need to adapt smartphone for academic purposes. As smartphone is an apparent basic necessity in today's digitalized

world, smartphone producers should produce smartphone with educational features, either physically or application install in smartphone. For example, smartphone should adapt a bigger screen that facilitate student's hedonic and utilitarian pleasure (see Ma et al. [63]). As students can be adrift on the purpose for academic, they should be guided in class with proper procedures and rules by instructors.

7. Conclusion

This study has shown that all nine hypotheses were found to be significant. Among the predictors of smartphone addiction, concentration is the strongest as it has the highest path coefficient among the three antecedents of smartphone addiction tested in this study. As students have heavy academic loads, shift in concentration would be a way for them to escape from their academic reality. Academic load can be stressful and exasperating for the majority of students as their coping mechanism towards intense academic load is not feasible compared to other age groups i.e. teenagers and working individuals (see Fauzi et al. [21]). Fear of missing out is a new variable that can be further studied in the context of smartphone addiction. The outcome shows that students do have fear that their friends are enjoying and experiencing good moments when one is not around. Fear of missing out is more prevalent in young adolescents in university who require influence of peers in shaping one's identity.

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Appendix: Items adapted in this study

NO	Variable	Item	Adapted from
1.	Instant	I use smartphone because it fulfills my needs immediately.	Liu et al. 2013
2.	gratification	The reason I use smartphone is to gain immediate gratification.	and Chen et al.
3.		I often use smartphone on an impulse because it brings me immediate enjoyment.	2018.
4.		I have used the smartphone to make myself feel better when I was down.	
5.	Mood	I have used the smartphone to make myself feel better when I've felt upset.	Caplan 2010
6.	regulation	I have used the smartphone to forget worries.	
7.		I have used the smartphone to forget about problems.	
8.	Convenience	I can use smartphone whenever I want.	Yoon and Kim
9.		I can use smartphone wherever I am.	(2007) and
10.		Using smartphone is effortless for me.	Chen et al. 2017
11.		I find it convenient to use smartphone.	
12.	Perceived	Using smartphone is enjoyable.	Zaman et al.
13.	enjoyment	Using smartphone is fun.	2010
14.		Using smartphone is interesting.	
15.	Concentration	When using smartphone, I am deeply engrossed.	Zaman et al.
16.		When using smartphone, I am absorbed intensely.	2010
17.		When using smartphone, I concentrate fully on it.	
18.	Smartphone addiction	While using mobile phones, I would think ??? just give me some more minutes. ???	Hong et al. 2012
19.		I have tried to decrease mobile phone usage time, but I have failed.	
20.		While not using the mobile phone, I still think about using the mobile phone and have visions about using the mobile phone.	
21.		Using mobile phone at night influences my sleep.	
22.		I try to reduce my mobile phone usage time.	
23.		Mobile phone usage influences my academic work.	
24.		I neglect academic work to spend more time on mobile phone usage.	
25.		My academic performance and concentration are influenced by mobile phone usage.	
26.		Before having to do something I always check the mobile phone to see whether there are missed calls or text messages.	
27.		I find myself wanting to use the mobile phone again.	
28.		When others ask me what I am doing when I use my mobile phone, I become defensive or secretive.	
29.	Fear of	I fear others have more rewarding experiences than me.	Przybylski et al.
30.	Missing Out	I fear my friends have more rewarding experiences than me.	2013
31.		I get worried when I find out my friends are having fun without me.	
32.		I get anxious when I dont know what my friends are up to.	
33.		It is important that I understand my friends ??? in jokes ???	
34.		Sometimes, I wonder if I spend too much time keeping up with what is going on.	
35.		It bothers me when I miss an opportunity to meet up with friends.	
36.		When I have a good time it is important for me to share the details online (e.g. updating status).	
37.		When I miss out on a planned get-together it bothers me.	
38.		When I go on vacation, I continue to keep tabs on what my friends are doing.	